A Clean Water Future for California

How California's Water Boards Can Clean Up Nine of the State's Biggest Polluted Rivers, Lakes and Bays

Sujatha Jahagirdar

ENVIRONMENT CALIFORNIA
RESEARCH & POLICY CENTER

February 2006

Acknowledgments

The authors would like to thank Kendra Riedt, John Rumpler, Tony Dutzik and Bernadette Del Chiaro for their editorial support. We would also like to acknowledge Andria Ventura of Clean Water Action and Sejal Choksi of San Francisco Baykeeper for assistance in reviewing the profile of the San Francisco Bay and providing inputs to the overall report.

In addition, we would like to thank those who provided supplementary technical and editorial input, including Gary Mulcahy of the Winnemem Wintu Tribe, Alan Levine of the Coast Action Group, John Friedrich of the League to Save Lake Tahoe, Bill Jennings of the California Sportfishing Protection Alliance, Lindsey Purnell of the California Hydropower Reform Coalition, Kelly Catlett of Friends of the River, Mark Gold, Leslie Mintz and Heather Hoecherl of Heal the Bay, Marcia Hanscom of Wetlands Action Network, Peter Nichols of Humboldt Baykeeper, Gabrielle Solmner of San Diego Coastkeeper, David Beckman, Anjali Jaiswal, and Jared Huffman of the Natural Resources Defense Council, Chuck Lamb of the Clear Lake Environmental Action Network, Martin Balding of the Eagle Lake Audubon Society, and Craig Tucker, campaign coordinator for the Karuk Tribe.

Thanks also to Greg Frantz and Judith Unsicker of the Lahontan Regional Water Quality Control Board, Les Grober, Patrick Morris and Joe Karkoski of the Central Valley Regional Water Quality Control Board, Shelley Luce of the Santa Monica Bay Restoration Commission and Richard Sugarek of U.S. EPA, Region IX, for providing factual and technical edits to the report.

Environment California Research & Policy Center's Clean Water Program is grateful to the San Francisco Foundation, the Wallace Genetic Foundation and the California Endowment for their support.

The authors alone are responsible for any factual errors. The recommendations are those of Environment California Research & Policy Center. The views expressed in this report are those of the authors and do not necessarily reflect the views of our funders, those who provided editorial and technical review, or their employers.

Environment California Research & Policy Center is a 501 (c)(3) organization that focuses exclusively on protecting California's air, water and open spaces. Drawing upon 30 years of experience, our professional staff combines independent research, practical ideas and effective educational campaigns to win real results for California.

For additional copies of this report, **visit www.environmentcalifornia.org.** or send a check for $25 made payable to:
Environment California Research & Policy Center
3435 Wilshire Blvd, Ste 385
Los Angeles, CA 90010 info@environmentcalifornia.org

Table of Contents

Santa Monica Bay *(© iStockphoto International)*

Executive Summary

To restore nine of the largest polluted waterways in the state to health, legally mandated cleanup plans drafted by California's water boards must be strengthened. To put the state on a path to a clean water future, the plans should stop new pollution from entering the waterways, clean up existing contamination, ensure flows sufficient to maintain healthy water quality and restore essential habitat.

California's waterways are at a crossroads. On our current path lies a future filled with great bays too polluted to swim in much of the year, signature rivers emptied of salmon, and vital drinking water sources polluted by pesticides and other chemical pollutants.

This future, however, is not inevitable.

Under a 1997 U.S. EPA policy and several court orders, California's water boards are required to establish cleanup plans called Total Maximum Daily Loads, or TMDLs to clean up the state's most polluted waterways in the next decade. Through a series of straightforward measures in these legally mandated plans, the water boards have the potential to make Santa Monica Bay safe for swimming throughout the year, return salmon to the San Joaquin and protect the clarity of Lake Tahoe.

While current state and federal law provide the authority needed to adopt strong clean-up plans, many plans that have already been drafted do not fully use this authority to ensure that nine of the largest polluted waterways in the state will be cleaned up.

Without a change in direction, cleanup plans for the waterways profiled in this report may simply codify the status quo and miss the historic opportunity to clean up many of California's largest polluted bays, rivers and lakes.

California's State Water Board and Regional Water Boards should shift course. To fulfill their legal mandate, cleanup plans they draft should include a series of straightforward measures that

- Require dramatic reductions in new pollution such as agricultural and stormwater runoff reaching our largest waterways
- Establish a renewed California Superfund program to clean up existing toxic contamination, which is paid for by polluting industries

- Compel dam operators to allow river flows sufficient to maintain healthy waterways and
- Increase funding for habitat restoration

With the adoption of such measures in cleanup plans, California's water boards can put the state on a path to a clean water future.

The Bays: Santa Monica Bay, Humboldt Bay and San Francisco Bay

California's great bays collect large amounts of contamination such as grease, trash and toxic pesticides from inland areas and highly developed coastal cities. The destruction of local habitat exacerbates this problem by weakening nature's ability to filter out the pollution before it reaches the bays. Wastewater treatment plants also discharge a range of toxic constituents which, while less in volume than the pollution contained in urban runoff, can be highly concentrated.

Air pollution is also a significant source of contamination in the waterways. A consequence of this contamination is mercury and Polychlorinated biphenyl (PCB) pollution that coats bay floors in many areas and builds up in marine life, threatening the health of subsistence fishermen.

Cleanup plans for Santa Monica Bay contain several strong requirements to limit trash entering the waterway, redirect stormwater to treatment plants and reduce toxic chemical pollution. Plans to clean up PCBs and dioxin pollution, however, have yet to be established for Humboldt Bay and a proposed cleanup plan for mercury in San Francisco Bay was recently rejected by the State Water Board as insufficient to address the pollution.

To bring California's largest bays back to health, California's water boards should ensure that cleanup plans:

Stop New Pollution: Cleanup plans should require the full enforcement of existing clean water laws and commit to specific inspection schedules and other measures that will ensure mandated pollution reductions are met. Plans should also require that stormwater polluters adhere to the same strong pollution reduction standards as other sources of pollution. Such an effort would include strong permits that contain numeric limits for stormwater pollution. Cleanup plans should also require that wastewater treatment plants reduce the pollution they discharge into the bays to the maximum extent possible. The North Coast Regional Water Board should also recognize Humboldt Bay as seriously polluted with the extremely toxic chemical dioxin and pursue the polluters responsible to immediately clean up sources of contamination.

Clean Up Existing Pollution: To ensure cleanup of toxic mercury and PCB 'hot spots' in the bays, cleanup plans should establish a renewed California Superfund program, paid for by polluting industries. Regional water boards should also pursue polluters directly responsible for legacy PCB pollution in the bays for cleanup funds.

Restore Habitat: Where feasible, cleanup plans should require restoration of coastal and watershed habitat for creeks, estuary and streams that naturally filter water entering the bays and shelter wildlife. Specifically, cleanup plans should support local restoration efforts around San Francisco and Humboldt Bay and recommend genuine stewardship of the Ballona Wetlands and threatened lagoons that line Santa Monica Bay.

The Rivers: The Sacramento, San Joaquin and Klamath

New pollution continues to enter three of the largest polluted rivers in the state.

Agricultural operations leak farm waste that can contain pesticides, salt, toxic metals and nutrients into the waterways. Urban runoff also carries numerous pollutants into the rivers and legacy mercury pollution leaked into the San Joaquin and Sacramento rivers from old mine sites threatens the health of local communities and river ecosystems. Low flows from dams and water diversions in the Klamath River and San Joaquin River have devastated local fish populations and degraded water quality. The destruction of wetlands and forests that lined the waterways removed important buffer zones that can filter out pollution before it reaches river waters.

Despite their degraded state, a cleanup plan for the Klamath River has yet to be drafted and existing cleanup plans for the Sacramento and San Joaquin Rivers do not require dramatic reductions in agricultural pollution, a comprehensive plan to clean up toxic contamination, safeguards against increased use of more dangerous pesticides or ensure water flows necessary to protect water quality.

To return these rivers to health, California's water boards should ensure that cleanup plans:

***Stop New Pollution*:** Cleanup plans should require dramatic reductions in the amount of agricultural pollution entering the Klamath, San Joaquin and Sacramento rivers. Officials can do this by issuing strong clean water permits that require significant and measurable reductions in agricultural pollution, overall reductions in pesticide use and agricultural water conservation measures that reduce the amount of irrigation water released into the waters. In addition, the state should order mining operations in the Klamath River that degrade water quality to immediately cease operation.

***Clean Up Existing Pollution*:** Cleanup plans should establish a renewed California Superfund Program, paid for by polluters, which will clean up pollution from mines. Until contamination is fully addressed, plans should also establish aggressive risk reduction programs to protect the health of surrounding communities from exposure to toxic pollution.

Ensure Sufficient Flows: Cleanup plans should require that dams on the Sacramento, San Joaquin and Klamath are operated in a manner that ensures the water quality of the river downstream is healthy enough to sustain vibrant fish populations and larger ecosystems. Specifically, plans should withdraw water rights and withhold Clean Water Act certification for dams that degrade downstream water quality. In addition, the Central Valley Regional Water Board should establish limits on salt pollution for the entirety of the San Joaquin River and require increases in water releases from Friant Dam to meet these limits.

Restore Habitat: Cleanup plans should require, where feasible, funding for the establishment of protective vegetative buffer zones along the waterways that will further protect them from further pollution.

The Lakes: Clear Lake, Eagle Lake, and Lake Tahoe

Despite strong measures to curtail urban runoff into Lake Tahoe, a lack of development around Eagle Lake and a cleanup plan for mercury pollution in Clear Lake, three of the largest polluted lakes in California face several remaining challenges on the road back to health. New pollution continues to enter Lake Tahoe and Clear Lake. Nitrogen and phosphorous deposited by urban runoff and air pollution fuel the growth of algae that chokes off oxygen and clouds Lake Tahoe. Fine particles of dirt pollution, called sediment, are carried into the lakes by runoff and erosion of streams and further

threaten its clarity. The pollution of the lakes is exacerbated by the destruction of local wetlands that can filter out pollution. Eagle Lake and Clear Lake also face a set of unique challenges: Non-native Eastern brook trout interferes with the ability of native Eagle Lake rainbow trout to reproduce naturally. Mercury pollution from an inactive mine on its banks seriously impairs Clear Lake.

Despite the seriousness of the issues facing the lakes profile din this report, cleanup plans for Lake Tahoe and Eagle Lake have yet to be drafted and the cleanup plan for mercury pollution in Clear Lake does not guarantee ongoing funding for continued cleanup efforts.

To bring these lakes back to health, cleanup plans should:

Stop New Pollution: Cleanup plans should restrict development that contributes to the runoff of nitrogen, phosphorous and fine particle pollution and strengthen runoff controls on existing development. In addition, working with state and local air quality officials, the plans should limit air pollution that deposits nitrogen contamination into Lake Tahoe. Finally, cleanup plans should stop new pollution entering the waterways from septic tanks.

Clean Up Existing Pollution: Cleanup plans should establish a renewed California Superfund program, paid for by polluters, which will ensure funding for cleanup of pollution caused by old mine sites.

Restore Habitat: Where feasible, cleanup plans should require the restoration of wetlands habitat and the establishment of buffer zones along lakeshores and lake tributaries that will revive ecosystems, filter pollution and prevent the erosion of streams into the lakes. The Lahontan Regional Water Board should also list Eagle Lake as seriously polluted with non-native fish species and take steps to control non-native fish species that hinder the natural life-cycles of native fish populations.

Introduction

California's Largest Waterways Are Central to Our Way of Life

From the salmon runs of the Klamath River to the sun-soaked shores of Santa Monica Bay, California's bays, rivers and lakes are central to the state's way of life. The Sacramento and San Joaquin rivers help provide drinking water to more than 22 million Californians;[1] Humboldt Bay and San Francisco Bay estuaries host millions of birds as they migrate from the Arctic to South America and the kelp beds on the bottom of Santa Monica Bay form one of the most important zones of marine biodiversity in the world.[2] Lake Tahoe is one of North America's deepest lakes and Clear Lake may be the continent's oldest.[3]

The importance of California's waterways extends beyond their contribution to our quality of life and the state's ecology. The health of California's largest waterways is fundamentally linked to our state's economy. California's bays, rivers and lakes have helped make the state the country's number one tourist destination.[4] Attracting 45 million visits each year—up to 500,000 each day in the summer—Santa Monica Bay is a major economic driver for Southern California.[5] According to the American Sportfishing Association, in 2003 sportfishing contributed more than $4 billion to California's economy and supported more than 43,000 jobs.[6]

Degradation of These Waterways is a Major Threat

Despite their importance to the state's economy, ecology and the health and safety of its people, California's largest bays, rivers and lakes are severely polluted. 90 percent of Santa Monica Bay is contaminated at levels that impact wildlife.[7] Scientists estimate that without immediate intervention, Lake Tahoe will lose its clarity within 30 years. The Elem Indian Colony that subsisted largely on Clear Lake fish for more than 11,000 years can no longer eat what the lake provides for fear of mercury

UC Davis scientists believe that without immediate action, pollution will cause Lake Tahoe to lose its clarity within 30 years.

State and Federal Requirements for Waterway Cleanup Plans in California

1. On a contaminant-by-contaminant basis, compile a list of all seriously polluted waterways. For large waterways, this will often result in the need to draft multiple cleanup plans.
2. While maintaining the ultimate goal of the Clean Water Act to eliminate all pollution, establish the maximum amount of contamination each waterway can absorb and support its designated uses.
3. For each contaminant, identify the sources of pollution into the waterway.
4. Establish requirements, with clear timelines and goals, that ensure the waterway will be returned to health.

poisoning.[8,9] Testing in waterways that flow into the San Joaquin River found toxic contamination in 59 percent of tests conducted and degraded water quality caused by water diversions and low flows of water released by dams have decimated fish populations in the San Joaquin and Klamath rivers. [10]

Cleanup of California's Waterways is Required By Law

While the waterways profiled in this report remain seriously polluted, the good news is that California's water boards are legally required to clean them up.

Federal Requirements

In 1972, Congress passed the Clean Water Act. The goals of this landmark law were to restore and maintain the chemical, physical and biological integrity of the Nation's waters, clean up the nation's waterways by 1983 and eliminate new pollution discharge into waterways by 1985.[11,12]

While the ultimate goal of the Clean Water Act is to restore the health of the nation's waterways, section 303d's TMDL program is its most important tool to clean up the most polluted waterways in the state. To achieve the goals of the Clean Water Act, TMDL programs states must, on a contaminant by contaminant basis, first compile a list of all seriously polluted waterways and then calculate the pollution reductions necessary to restore the waterway to health. A waterway is returned to health when it can meet water quality objectives and standards for each contaminant necessary to support swimming, fishing, healthy ecosystems and other designated beneficial uses of the waterway.[13]

The requirement to translate the pollution allocations contained in TMDLs into real action to clean up contamination is outlined in federal law. The Clean Water Act requires that pollution permits are modified to require compliance with pollution reduction requirements contained in a TMDL.[14] In 1997, the U.S. Environmental Protection Agency (EPA) also issued regulations stating that when a TMDL calls for significant reductions in runoff pollution, states must also provide 'reasonable assurance' that the reductions will occur "in a manner that results in attainment of water quality standards."[15]

State Requirements

In California, the responsibility for drafting plans to clean up the state's waterways falls to the California State Water Resources

Control Board (henceforth referred to as the State Water Board) and nine semi-autonomous Regional Water Quality Control Boards (henceforth referred to as Regional Water Boards).

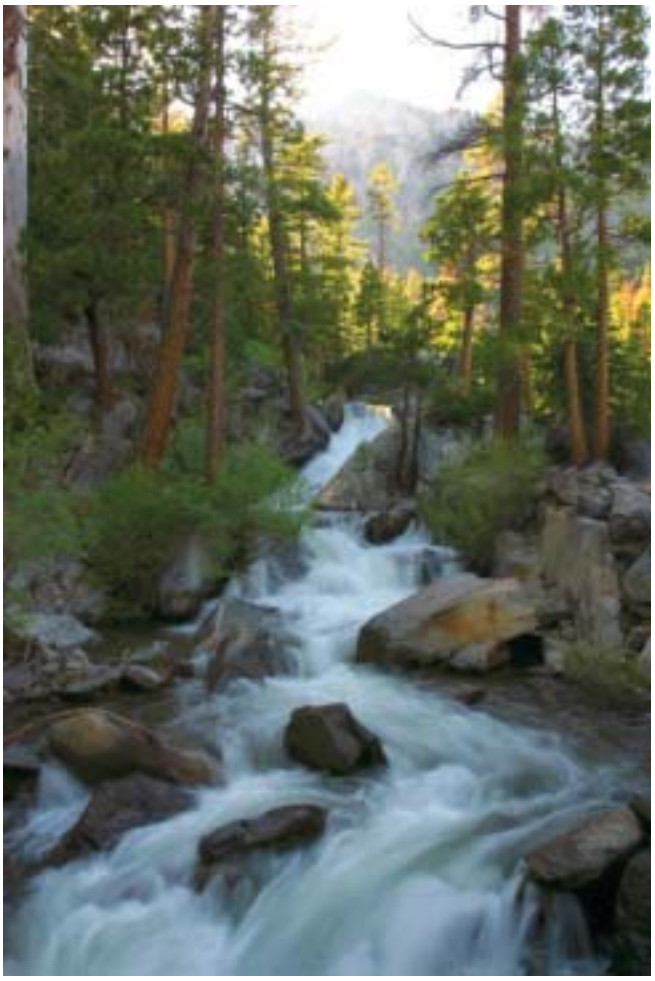
The California Porter Cologne Water Quality Act

Under the Act, the responsibility for actually cleaning up our waterways falls to the regional water boards. The local boards first develop the list of seriously polluted waterways and pollution reductions necessary to return the waterways to health. Though enacted a few years earlier, the Act complements the intent of the Clean Water Act and requires the state to develop implementation plans to ensure that the pollution control objectives outlined in a TMDL are reached.[16] According to state law, an implementation plan must include a description of actions that are necessary to achieve the objectives, a time schedule for these actions, and a description of surveillance to determine compliance with the objectives.[17] These implementation plans must then be incorporated into the overall water quality plans for individual regions, called 'basin plans.[18] Basin plans provide a mandatory blueprint for action to clean up the waterways in the area and are legally enforceable against polluters and other state agencies.[19]

State Water Board Policy

The State Water Board can also adopt statewide policies to guide the formulation and implementation of TMDLs. Because it must ultimately approve a TMDL in order for it to take effect, the state water board can also require the inclusion of specific policies in cleanup plans in order to approve their adoption.

In 2005, for example, the state water board adopted a policy to guide regional water boards as they draft cleanup plans under the Clean Water Act TMDL program. According to the policy, a TMDL implementation plan should include:



A Lake Tahoe-region waterfall at sunset

- Descriptions of the actions necessary to achieve water quality standards. For TMDLs, they are actions to achieve waste load and load allocations and numeric targets
- Action to resolve key uncertainties and verify key assumptions
- A schedule and key milestones for the actions to be taken
- Monitoring and surveillance to be undertaken to determine compliance with the water quality standards. For TMDLs, this includes tracking and evaluating actions and attainment of waste load and load allocations and numeric targets[20]

In addition, in 2004 the State Water Board adopted the "Policy for Implementation and Enforcement of the Non Point Source Pollution Control Program." The policy reiterates the ability of California's regional water boards to require polluters to reduce runoff pollution and enforce stormwater pollution reduction requirements against individual polluters.[21] These policies reiterate the need for regional water boards to draft strong clean up plans. They also underscore the expansive authority offered by state and federal law to restore our waterways health.

A Fork in the Road

In drafting clean up plans, the regional water boards and state water board should fully exercise this authority and outline specific measures in TMDLs that will stop pollution, clean up existing pollution, ensure sufficient flows and restore habitat.[22]

If California's water boards fulfill their legal mandate and utilize all the regulatory authority available to them in the next decade, they could put into place the policies necessary to secure a clean water future for our children.

Waterway Profiles: The Bays

San Francisco Bay

Profile Summary

From legacy mercury to continuing discharges from wastewater treatment plants, San Francisco Bay faces numerous threats. Despite its degraded state, none of the required San Francisco Bay cleanup plans have been finalized. A cleanup plan for mercury proposed by the San Francisco Bay Regional Water Board this September was rejected by the State Water Board as insufficient to rid the bay of the contamination.

Recommendations for Strong San Francisco Bay Cleanup Plans

Stop New Pollution

- Issue strong clean water permits that hold stormwater pollution to the same reduction requirements as other types of pollution. This should include establishing numeric pollution limits for urban runoff
- Enforce existing pollution reduction requirements
- Require maximum feasible pollution cuts from wastewater treatment plants
- Upgrade wastewater and stormwater infrastructure to prevent spills during heavy rains
- Encourage municipalities to adopt local ordinances that curb runoff from new development, construction sites and other sources of pollution

Clean Up Existing Pollution

- Pursue polluters responsible for toxic pollution of the bay for cleanup costs
- Establish a renewed California Superfund program that will pay to clean up toxic hot spots in bay, when responsible parties cannot be identified
- Implement an aggressive risk reduction program to limit community exposure to toxic contamination while cleanup occurs

Restore Habitat

- Support community efforts to accelerate restoration of degraded wetlands and other habitat that once lined the bay

Overview

Encompassing more than 1,600 square miles, the San Francisco Bay estuary is home to 90 percent of the state's remaining coastal wetlands.[23] Millions of birds use the estuary as a home or a stopover during spring and fall migrations.[24] In total, the region supports more than 750 species of animals.[25] In addition to its ecological importance, San Francisco Bay is also at the heart of a densely developed metropolitan area, supporting a wide variety of human activity. The waterway simultaneously serves as a harbor, transportation hub and commercial and recreational center.

While San Francisco Bay's ecological and economic value is clear, this national treasure is victim to more than a century of habitat destruction and pollution. According to the U.S. Geological Survey, some bay locations are among the most highly polluted coastal sites in the United States.[26] Each year, an ecological index issued by the San Francisco Bay Institute measures the health of the bay through several different parameters. According to the Institute's 2005 Index, the 2004 abundance of native bay-dependent fish species was less than half of the level measured three years earlier. Today, bay oysters are nearly extinct.[27] Only 27 percent of the historic seasonal wetlands of the bay remain. In 2004, San Francisco County issued 162 beach closings and advisories due to pollution.[28,29] Mercury and pesticides carried through area creeks and waterways flowing from the Central Valley also contaminate the bay.[30]

While the Clean Water Act TMDL program provides an historic opportunity to clean up San Francisco Bay, initial cleanup plans proposed by the San Francisco Bay Regional Water Board will neither require mercury pollution reduction from all sources nor restore the bay to health this century. The weaknesses of this plan highlight the danger that California's water boards may miss the opportunity to draft cleanup plans that ensure a clean water future for the largest polluted waterways in the state.

Threats to the Health of San Francisco Bay

New Pollution

Toxic Runoff

The U.S. Geological Survey estimates that runoff dumps about 3 million gallons of oil into the bay every year.[31] A 1993 study by the Survey also concluded that large "pulses" of diazinon, a toxic pesticide that is poisonous to wildlife and humans in very small quantities, and carried into the Sacramento and San Joaquin rivers by runoff, flows into San Francisco Bay.[32] Urban runoff from lawns and other sources also carries pollution into the bay through local creeks.[33] While levels of diazinon pollution in the bay are falling due to a federally-mandated phase out of the pesticide for residential use, experts fear that the pollution may be replaced by a new class of pesticides called pyrethroids that may be even more toxic to fish and other aquatic wildlife.[34]

Wastewater Treatment Plants

The U.S. Geological Survey estimates that each day San Francisco Bay receives more

According to the U.S. Geological Survey, some San Francisco Bay locations are among the most highly polluted coastal sites in the United States.

than 800 million gallons of municipal wastewater, containing large volumes of contamination. This wastewater contains 60 tons of nitrogen pollution each day that can fuel the growth of algae and harm bay ecosystems.[35] While some publicly owned treatment works, or POTWs, have adopted strong pollution prevention measures to cut levels of toxins such as mercury in their discharges, some POTWs continue to contribute significant sources of pollution to the bay.

Air Deposition

Air pollution is a significant source of mercury pollution in the bay. A 2001 study conducted by the San Francisco Estuary Institute detected mercury in the air around San Francisco Bay at twice the expected background level. The study estimated that each year air pollution is responsible for a large percentage of the mercury pollution entering the bay.[36] Despite this threat, the San Francisco Bay Regional Water Board's proposed cleanup plan for mercury in the bay does not require any reductions in contamination from local sources of air pollution. The plan also does not require potentially large air sources, like oil refineries, to complete full studies to determine the full extent of their mercury emissions.[37]

Existing Pollution

Mercury and PCB Contamination

Toxic mercury and PCBs, chemicals linked to serious health problems like nervous system damage and cancer, coat the bottom of San Francisco Bay in many places. The contamination threatens local wildlife and poses a major public health risk. Most of the mercury pollution originates from mining waste once leaked into Central Valley waterways that flow into the bay. The New Almaden Mines, an enormous historic mercury extraction operation, for example, has released large amounts of mercury pollution into the Guadalupe River, which flows into San Francisco Bay.[39]

Though smaller in quantity, new mercury pollution also continues to enter San Francisco Bay through discharges from wastewater treatment plants. This pollution can be much more easily curtailed than pollution entering the waterway from old Central Valley mines. Prevention programs that collect mercury from dental offices before it has a chance to enter the waste stream, for example, are exponentially cheaper than establishing a comprehensive program to pay for the cleanup of abandoned mines throughout the Central Valley. Despite the relative ease of reducing mercury levels in the waste stream, the proposed cleanup plan for mercury pollution in the bay does not require wastewater treatment plants to adopt mercury pollution prevention programs targeting sources like dental offices.

The plan also does not offer a comprehensive program to clean up toxic hot spots on the floor of the bay.

Fish consumption advisories issued by the Office of Environmental Health Hazards Assessment to protect subsistence fishermen and Bay Area residents from mercury—contaminated fish have not been sufficiently disseminated or understood by fishermen who fish to provide their families with food. In addition, sometimes when advisories are understood they cannot be heeded because some have no alternate source of food.[40] Despite the weakness in existing protections, the San Francisco Bay Regional Water Board's proposed plan to clean up mercury pollution in the bay does not establish a comprehensive program to protect fishermen from toxic pollution while cleanup occurs.

Many of the weaknesses of the San Francisco Bay Regional Water Board's proposed cleanup plan for mercury are repeated in early drafts of a plan to clean up Polychlorinated biphenyl (PCB) pollution in the bay. Despite the threat that PCB hot spots pose to the bay's ecosystem and the health of surrounding communities, early drafts of the plan do not establish comprehensive programs to either clean up PCB hot spots in the bay or reduce the risk of toxic exposure to fishermen while cleanup occurs.

The Need for Stronger Implementation Plans: Mercury in San Francisco Bay Case Study

Mercury pollution in San Francisco Bay poses a major threat to the health of local subsistence fishermen who rely on fish and other seafood from the waterway for food. Recognizing the importance of addressing the problem, the San Francisco Bay Regional Water Board tackled mercury pollution in the bay in its first cleanup plan proposed under the Clean Water Act TMDL program.

The cleanup plan proposed by the San Francisco Bay Regional Water Board and presented for approval to the State Water Board in 2005 accurately estimated the levels of mercury pollution afflicting the bay and correctly identified the sources of contamination. The measures proposed to ensure cleanup of contamination, however, did not establish an aggressive effort to clean up contamination as quickly and thoroughly as possible.

Among the proposed cleanup plan's weaknesses:

1. A strong cleanup plan for mercury pollution in San Francisco Bay should prevent new mercury pollution from entering the waterway. The San Francisco Bay Regional Water Board's proposed plan, however, does not require wastewater treatment plants to adopt strong pollution prevention programs or require them to reduce new mercury pollution entering the bay as much as possible.

   While a smaller source of pollution than Central Valley waterways that carry legacy contamination from mines, mercury pollution from wastewater treatment plants can be reduced relatively easily. Requiring dentists to reduce disposal of mercury-containing dental amalgam through the region's wastewater system, for example, could significantly reduce the amount of mercury pollution entering the waste stream. The effectiveness of such programs has been demonstrated successfully in the Great Lakes region.[42]

2. The proposed cleanup plan also does not set individual pollution reduction goals for wastewater treatment plants, but allows the plants to comply with a total 'group' allocation. This group approach means that wastewater treatment plants cannot be held accountable to individual pollution reduction goals. In addition, because such coalitions are not legally recognized entities, it is virtually impossible to enforce pollution reduction requirements for which they are responsible.

See* NEED *continued on next page

Habitat Destruction

The destruction of habitat exacerbates the pollution problems facing San Francisco Bay. Historically, the bay was ringed with wetlands and marshes that not only supported an abundance of wildlife, but also naturally filtered contamination. The loss of more than three-quarters of this habitat in places

like Central San Francisco Bay has greatly impacted water quality.[41]

Recommendations for Strong San Francisco Bay Cleanup Plans

In order to clean up San Francisco Bay, the San Francisco Bay Water Board has proposed a cleanup plan for mercury and begun work on several other cleanup plans. To seize the opportunity to ensure full cleanup of bay pollution in a timely manner, the cleanup plans should issue strong clean water permits to reduce stormwater pollution, enforce existing pollution reduction laws, require cuts in pollution from wastewater treatment plants, restore habitat around the bay, include strong requirements to clean up toxic 'hot spots' in San Francisco Bay, and mandate reductions in overall pesticide use.

Stop New Pollution

Issue Strong Clean Water Permits

While San Francisco County owns and operates the only combined wastewater and stormwater system in a coastal county of California, urban runoff pollution emitted by municipalities, construction sites and

NEED ***continued from previous page***

3. In addition, the plan does not require reductions in mercury pollution from refineries, although air pollution from these facilities is a significant source of mercury contamination in the bay.
4. The plan does not establish a comprehensive program to reduce the risk of toxic exposure while cleanup occurs to subsistence fishermen while clean up occurs.
5. Finally, the plan does not propose a comprehensive program that would fund cleanup of toxins already in the bay.

The cleanup plan for mercury proposed for San Francisco Bay does not seize upon the historic opportunity to restore the bay to health.

Even more alarmingly, the board may be poised to replicate the many of weaknesses of its mercury plan in its cleanup plan for PCB pollution in San Francisco Bay.

Fortunately, in September 2005 the State Water Board refused to approve the San Francisco Bay Regional Water Board's proposed cleanup plan for mercury. Finding the plan inadequate, the State Water Board directed the San Francisco Regional Water Board to revise its plan to strengthen pollution prevention requirements for wastewater treatment plants, establish individual pollution limits for wastewater treatment plants, and investigate ways to reduce dangerous exposure to subsistence fishermen and other affected communities.[43]

The weakness of the proposed cleanup plan for mercury in San Francisco Bay warns of the potential pitfalls involved in drafting cleanup plans under the Clean Water Act TMDL program. Without strong measures to stop new pollution and clean up existing contamination, cleanup plans can simply codify the status quo instead of putting the state on a path toward a clean water future.

industrial facilities continues to pose a major threat to the health of San Francisco Bay.

A primary reason for the failure to eliminate stormwater pollution to San Francisco Bay exists because the vast majority of stormwater permits issued in California do not require sources of stormwater pollution to meet the same strong pollution reduction requirements as pollution discharged from facilities directly into waterways. Instead of meeting permit requirements that ensure a waterway will not receive more pollution than it can handle, stormwater polluters are only required to comply with a vague standard that assures local water officials that "they are trying as hard as they can." This weak standard means that waterways like San Francisco Bay are often not fully shielded from pollution that will degrade its water quality below clean water standards.

This year, however, the California Supreme Court ruled that regional water boards have the authority to hold stormwater pollution to the same cleanup standards as other types of pollution. This victory paves the way for regional water boards around the state to issue strong permits that limit stormwater pollution in the same way that other types of pollution are limited.

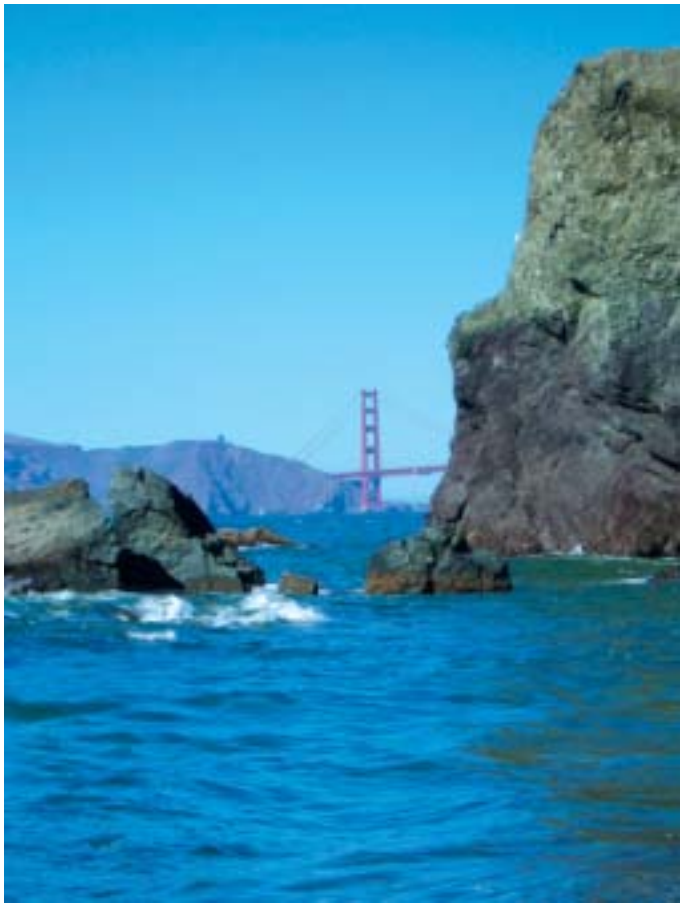
The ruling also further clarifies the authority of regional water boards around the state to establish numeric pollution limits in clean water permits to limit stormwater pollution. Current stormwater dischargers to San Francisco Bay are regulated largely through general stormwater permits issued to municipal facilities, construction sites and industrial facilities. These permits require a group of polluters to meet non-specific and hard-to-enforce requirements to cut stormwater pollution. The deficiency in this 'narrative' approach is clearly evidenced in the high levels of urban runoff pollution that continue to flow into the bay. The ability of the state to establish numeric pollution limits is also outlined in the state's own "Plan for California's Nonpoint Source Pollution Control Program," which states that if voluntary programs are ineffective, the state can establish mandatory pollution limits.[44]

Cleanup plans for San Francisco Bay should require stormwater polluters to comply with strict numeric pollution limits that will fully protect the waterway from pollution.

Cleanup plans for San Francisco Bay should require stormwater polluters to comply with strict numeric pollution limits that will fully protect the waterway from pollution. Required to comply with numeric effluent limitations that can be easily enforced, municipalities will be much more likely to adopt aggressive ordinances or mobilize public support for large structural improvements; industrial facilities will be much more likely to adopt pollution prevention measures; and construction sites will be much more likely to curb pollution that runs from project sites.

Enforce Existing Pollution Reduction Laws

While wastewater treatment plants and other 'point' dischargers have significantly reduced the levels of pollution they discharged into the bay, the seriousness of the waterway's impairment makes additional reductions necessary. The federal Clean Water Act requires the periodic revision of pollution permits issued to these facilities to ensure that they are employing the best available technology to reduce pollution as much a possible. In its most recent review, however, the Legislative Analyst's Office of the California Legislature found that at the beginning of 1998-99, 400 out of 2,400 permits had not been reviewed and updated.[45] Cleanup plans for San Francisco Bay should require that these permits are



San Francisco Bay simultaneously serves as a harbor, transportation hub and commercial and recreational center
(© iStockphoto International)

immediately revised to require the adoption of best available technology.

Cleanup plans for San Francisco Bay should also include a commitment for inspections to assure compliance. According to the LAO, inspections to determine compliance with clean water permits occur infrequently around the state. In 1998-99, for example, the LAO found one regional board had conducted only 25 percent of the inspections committed to in its annual work plan.

Improve Infrastructure

Unlike every other coastal county in California, the county of San Francisco treats stormwater before it reaches San Francisco Bay. This infrastructure prevents much of the runoff pollution that enters waterways such as Santa Monica Bay from similarly impacting San Francisco Bay. Despite the benefits of this system, however, the combined wastewater/stormwater system can leak during times of heavy rain. During these times, the combined system can leak sewage and wastewater into the bay, threatening the health of the bay ecosystems and surrounding communities. The county of San Francisco is already planning to upgrade its system to prevent such overflows and spills in times of heavy rains. Cleanup plans adopted for San Francisco Bay should support this effort. [46]

Encourage Municipal Ordinances to Prevent Pollution

Bay area local governments are exploring efforts to reduce pollution before it reaches area storm drains. In 2005, the San Francisco City Council debated the merits of imposing a fee on plastic bag usage that would reduce a major element of trash pollution in the bay.[47] Bay Area water officials have also engaged Detroit auto manufacturers to reduce the amount of copper used to line brake pads.[48]

Municipal requirements to reduce chemical emissions and waste generation can also contribute significantly to reductions in urban runoff. For example, emissions of zinc, a toxic metal dangerous to wildlife, can be significantly reduced with simple technology upgrades. The runoff reduction consulting firm Stormwater Management Inc. describes working with a San Diego zinc galvanizing company to install tanks on the property that catch zinc-contaminated stormwater and recycle it, rather than releasing it to the local stormwater system. This system successfully reduced zinc pollution emissions from the facility by 87 percent.[50] Discharges of polluted dirt from construction sites can also be similarly controlled by creating holding areas for stormwater or allowing for percolation of water on the property. In addition, new commercial and housing developments and renovations can be required to incorporate more green space into their landscapes in

order to allow the absorption of water into the ground.

Reduce Pollution from Wastewater Treatment Plants

Cleanup plans for mercury in San Francisco Bay should require wastewater treatment plants to reduce the contamination they release into the bay as much as possible. In the Great Lakes region, for example, wastewater treatment plants are spearheading aggressive pollution prevention efforts that aim to significantly reduce the use of mercury in the healthcare, industrial and domestic sectors.

The Western Lake Superior Sanitary District in Duluth, Minnesota, for example, successfully implemented a dental mercury pollution reduction program that prevented 100 pounds of raw mercury from moving through its system.[49] Cleanup plans should require the replication of such efforts in San Francisco Bay.

Reduce Air Deposition

The San Francisco Bay Regional Water Board should establish the strongest possible restrictions on mercury pollution from refineries, and work with local air districts to cut other sources of airborne pollution. Such cooperation between air quality and water quality regulators is not unprecedented. In Minnesota, for example, writers of the state mercury cleanup plan outlined the following objectives for airborne mercury reductions:

To limit growth of mercury emissions because of construction of new or expanding emission sources in Minnesota, the MPCA will develop a permitting strategy for new and/or expanding air emissions sources of mercury that considers the following:

- *Establishing an appropriate facility de minimus emissions rate*
- *Requiring new or expanding sources to use state-of-the-art mercury control technology if the de minimus rate is not feasible/achievable/possible*[51]

Clean Up Existing Pollution

Establish Comprehensive Program to Clean Up Toxic Hot Spots in Bay

The cleanup plans for PCBs and mercury in San Francisco Bay should establish a renewed California Superfund program, paid for by polluters, which will enable the board to clean up toxic hot spots at the bottom of the bay. The San Francisco Regional Water Board should also pursue entities directly responsible for contamination for cleanup costs.

Reduce Risk of Pollution to Communities

Under its proposed plan, cleanup of mercury in San Francisco Bay could take as long as 120 years to accomplish.[52] While more stringent pollution prevention and cleanup actions may shorten this time-line, it will clearly take decades to bring water quality

Cleanup plans for mercury in San Francisco Bay should require wastewater treatment plants to reduce the contamination they release into the bay as much as possible. In the Great Lakes region, for example, wastewater treatment plants are spearheading aggressive pollution prevention efforts that aim to significantly reduce the use of mercury in the healthcare, industrial and domestic sectors.

and fish tissue standards back to safe levels and reduce the risk of exposure to communities. The same is true for other contaminants in the bay. Consequently, it is crucial to work with communities that will continue to be exposed to contamination while cleanup is occurring. As part of its cleanup plan for mercury and PCBs, the San Francisco Bay Regional Water Board should educate impacted communities, including those with large populations of subsistence or cultural anglers, about health issues related to eating highly contaminated fish and help these communities implement strategies that will lead to real exposure reductions and mitigation of health impacts.

Restore Habitat

Recognizing the importance of local habitat to filtering out pollution and restoring local ecosystems, a coalition of bay area environmental groups, businesses and local officials is working to add 60,000 acres of wetlands around the bay. This goal, however, is yet to realized and a stable funding source for the restoration has yet to be established. When feasible, cleanup plans for San Francisco Bay should require funding of this local effort.

Conclusion

The San Francisco Bay is the largest estuary on the West Coast and its health is seriously threatened by a toxic brew of contaminants and decades of habitat destruction. The toxic chemicals that plague the bay originate from a range of sources – from urban runoff to wastewater discharges to air pollution. Habitat destruction only exacerbates the problem by removing natural filtration systems that could partially shield the bay's waters. On our current path, legacy mercury pollution will continue to plague the bay for more than a century and runoff will continue to carry large volumes of toxic chemicals and other pollution into the bay. In order to seize the opportunity that the Clean Water Act cleanup program provides and shift our path toward a clean water future, the San Francisco Bay Regional Water Board should strengthen its approach and hold stormwater polluters to the same standards as other dischargers, require wastewater treatment plants to cut pollution as much as possible, establish a California Superfund program to clean up toxic hot spots in the bay, enforce existing pollution reduction laws and, finally, when feasible, require the restoration of lost wetlands that once lined the bay.

Humboldt Bay

Summary of Cleanup Plans

Despite the presence of PCBs and dioxin—chemicals linked to cancer and other health effects—no cleanup plan for Humboldt Bay has yet been proposed by the North Coast Regional Water Board.

Recommendations for Strong Humboldt Bay Clean Up Plans

Stop New Pollution

- List Humboldt Bay as polluted by dioxin and require responsible parties to stop further contamination

Clean Up Existing Pollution

- Establish a renewed California Superfund program to assure funding for clean up of toxic hot spots in bay
- Pursue polluters responsible for PCB pollution in bay for cleanup costs

Overview

The second largest natural bay in the state, Humbolt Bay forms the core of California's shellfish harvesting industry. Over 200 commercial vessels list Eureka as home port and over 500 vessels from other west coast ports use the bay's facilities annually to deliver fish and other seafood to buyers located in Humboldt County.[53]

Humboldt Bay is also one of the most pristine and ecologically important estuaries on the west coast of North America. Scientists have documented 141 invertebrate species, 110 fish species, 251 bird species, and 30 mammal species that depend on the bay's ecosystem. As a critical stop-over on the Pacific Flyway, the bay hosts millions of birds that follow the migration route each year.[54] The rugged and wind-swept coast of the bay also boasts extraordinary dune formations that have evolved into a delicate ecosystem.

Because of its narrow entrance, the bay was often missed as explorers sailed up the coast from San Francisco to Washington. As a result, the waterway has not experienced the development of its sister bays to the north and south.[55] Protected public lands like the Humboldt Bay National Wildlife Refuge and Arcata Marsh and Wildlife Sanctuary shield much of the remaining wild ecosystem as well.

Despite its historic protection, Humbolt Bay has not completely escaped contamination. PCBs, chemicals linked to cancer that build up in shellfish and other animals, and dioxin, one of the most toxic substances known to humans, threaten the ecosystem of the bay.[56] Cleanup plans for PCBs and dioxin have not yet been drafted by the North Coast Regional Water Board. Furthermore, local officials propose to expand dredging of the contaminated floor of the bay, which would deposit dredged materials on the beach, and make the problem worse.

Pelicans over Humboldt Bay *(photo credit: Humboldt Baykeeper)*

Threats to the Health of Humboldt Bay

New Pollution

Dioxin Contamination

The widespread use of the dioxin-containing pesticide pentachlorophenol by timber mills has created a major pollution problem in Humboldt Bay. Due to the persistence of dioxin in the environment, local tributaries carry the chemical from old contaminated mill sites into bay waters.[57] Despite its threat to the ecosystem of the bay, the North Coast Regional Water Board has not officially listed the bay as polluted by dioxin and aggressive measures to stop further dioxin from entering the bay have not been prioritized.

Existing Pollution

PCB Contamination

PCBs, toxic chemicals linked to cancer, pollute the soils at the bottom of Humboldt Bay. First manufactured by Swann Chemical Company in 1929, and then by Monsanto until 1977, the chemicals were once used in enormous quantities in a range of applications—from coating carbonless copy paper to lubricating electrical conductors.[58] In the 1970's, scientific studies linked PCBs to cancer and found that the chemical can build up in the food chain.[59] This buildup threatened all aspects of the food chain—from the small invertebrates that feed on the bottom of the ocean floor to the shellfish consumed by humans. In response to this discovery, the federal government banned the commercial production of PCBs within the United States in 1979.[60] Unfortunately, this ban came too late to prevent the contamination of waterways across the country with PCBs. Humboldt Bay was no exception.[61] PCB pollution deposited in the soil of Humboldt Bay poses a threat to the bay's ecology as well as to the people who eat contaminated wildlife.

The North Coast Regional Water Board should list Humboldt Bay as polluted by dioxin on the state's 'Impaired Waters' list and then pursue the owners of timber operations, that continue to leak dioxin into the bay through runoff, to clean up sources of pollution.

Recommendations for Strong Humboldt Bay Cleanup Plans

Stop New Pollution of the Bay

Ban Dredging That Spreads Pollution

Despite PCB and dioxin contamination in Humboldt Bay, last year port authorities proposed to expand dredging in the bay and deposit large quantities of dredged materials on bay beaches.[62] This large-scale dredging of the floor of Humboldt Bay could spread contamination in the bay and expose wildlife and local communities along the coast to hazardous toxins. In order to prevent contamination in the bay from getting worse, large-scale dredging should be prohibited until cleanup plans for dioxin and PCBs are formulated. At a minimum, cleanup plans for the bay should reject any proposal that would dump dredged materials contaminated with toxins on the shoreline.

Pursue Ongoing Dioxin Polluters

Despite dioxin pollution present in Humboldt Bay, the North Coast Regional Water Board has not listed it as a waterway that is polluted by the toxin on the state's 'impaired waters' list. Without this listing, the bay does not qualify for a comprehensive cleanup plan to prevent more dioxin from reaching its waters. The North Coast Regional Water Board should list Humboldt Bay as polluted by dioxin. Then they should aggressively pursue the owners of timber operations that continue to leak dioxin through runoff into the bay, to immediately clean up sources of pollution.

Clean Up Existing Pollution of the Bay

Comprehensive cleanup of PCB contamination in Humboldt Bay has yet to begin. To fund cleanup, the North Coast Regional Water Board should pursue parties responsible for large amounts of historic PCB emissions into the bay, as U.S. EPA has done with polluters responsible for PCB contamination off the Palos Verdes Shelf in Santa Monica Bay. If the parties responsible for contamination in the bay cannot be identified, the North Coast Regional Water Board should establish a renewed California Superfund program, funded by polluting industries, which will pay for cleanup.

Conclusion

Unlike many of its sister bays to the south and north, Humboldt Bay has been largely shielded from the large-scale development that often deteriorates water quality. Despite this historic protection, PCBs and dioxin pollution continue to threaten its ecosystem. On its current path, Humboldt Bay will remain polluted with dangerous toxins for centuries. The Clean Water Act TMDL program provides an opportunity to shift direction, clean up these dangerous toxins and secure a clean water future for the bay.

To draft plans that will clean up PCB contamination in Humboldt Bay, the North Coast Regional Water Board should pursue responsible parties for cleanup funds. If responsible parties cannot be found, the board should establish a California Superfund program, paid for by polluters, which would pay for cleanup of abandoned sites. At a minimum, the board should prohibit additional dredging of the bottom of the bay that would spread contamination. In addition, to address dioxin pollution, the North Coast Regional Water Board should officially recognize that Humboldt Bay is polluted with the toxin dioxin and pursue parties responsible for continuing pollution to immediately clean up sources of contamination.

Santa Monica Bay

Summary of Cleanup Plans

Urban runoff remains the single biggest threat to water quality in Santa Monica Bay. Additional contamination sources such as sewage spills, wastewater treatment plants and air pollution also further degrade bay waters. The destruction of habitat that lines the bay exacerbates the situation.

Santa Monica Bay Cleanup Plans Approved by the State Water Board Require

- Limits on trash pollution that enters the bay through the Los Angeles River and Ballona Creek
- Numerous diversions of urban runoff generated in dry weather to wastewater treatment plants
- Stronger limits on toxic metals discharged by wastewater treatment plants and via stormwater into the bay through the Los Angeles River and Ballona Creek

Recommendations for Strong Santa Monica Bay Clean Up Plans

Stop New Pollution

- Issue strong permits that hold stormwater to the same pollution reduction standards as other types of pollution
- Enforce existing pollution reduction requirements
- Encourage municipalities to adopt local ordinances that curb runoff from new developments, construction sites and other sources of pollution
- Stop pollution from septic systems
- Maintain federal funding for sewage system upgrades
- Work with local air quality officials to reduce the deposition of air pollution into the bay

Restore Habitat

- Commit to genuine restoration and stewardship of the Ballona Wetlands ecosystem
- Continue and initiate lagoon restoration projects along the bay

Experts estimate that 90 percent of Santa Monica Bay is contaminated at levels that impact wildlife.

Overview

One of the most visited waterways in the state, Santa Monica Bay is home to over 5,000 species of birds, fish, mammals, plants and other wildlife.[63] Many threatened and endangered species, such as the California Brown Pelican and Least Tern nest, forage or spend the winter around the bay.[64] The enormous kelp beds off the coast of Southern California are also the second most biodiverse communities known to exist in the ocean.[65] Furthermore, attracting 45 million visits each year and up to 500,000 each day in the summer, the bay is a major driving force for Southern California's economy.[66]

Despite its ecological and economic importance, water quality in Santa Monica Bay is severely degraded. Experts estimate that 90 percent of the bay is contaminated at levels that impact wildlife.[67] A 2005 'Beach Report Card' issued by the local environmental group Heal the Bay concluded that beach water quality in Los Angeles County is the worst in the state.[68] This contamination has had a serious impact on the local economy. According to the State Water Resources Control Board, beach attendance in Los Angeles County has dropped by 56 percent since 1983.[69]

The degradation of Santa Monica Bay is due to several factors. The single biggest source of pollution is urban runoff—trash, chemicals and grease that is washed into the bay by rainwater.[70] While the frequency of sewage spills has decreased in the past decade, they can still pose a serious threat to water quality. The deposition of air pollution is also a significant source of zinc, lead and other toxic pollutants. Point sources such as wastewater treatment plants and septic systems also continue to pollute the bay with a range of chemicals. In addition, approximately 95 percent of Santa Monica Bay's historical wetlands have been destroyed.[71]

The Clean Water Act TMDL program offers an historic opportunity to restore Santa Monica Bay to health. By issuing strong requirements that limit pollution from development, hold stormwater pollution to the same pollution reduction standards as other types of pollution, reduce air pollution, stop leakage from septic systems and prevent and fund sewage system upgrades, the bay can be restored for generations to come.

Threats to the Health of Santa Monica Bay

New Pollution

Urban Runoff

When rain falls in Southern California, the water flows over the region's lawns, pavement and roofs and into a 5,000 mile network of storm drains that empties into the Pacific Ocean.[72] On its journey to the sea, the rainwater picks up the chemicals, animal waste, grease and other pollutants that coat the urban landscape and deposits them in Santa Monica Bay. Each year, a staggering 30 billion gallons of runoff are discharged into the bay.[73] Primarily due to this runoff, over 4,000 tons of trash are collected from Santa Monica Bay beaches annually.[74] In addition to ruining the aesthetics of the beach, the runoff threatens public health. A 1996 study conducted by the Santa

Monica Bay Restoration Commission found that swimming near storm drains in the bay after a rain can increase the risk of viral infections, earaches, sinus problems, fever, flu and skin rashes.[75]

Deposition of Air Pollution

Air pollution is a significant source of toxic metal pollution in the bay. A 2001 study conducted by the Santa Monica Bay Restoration Commission and UCLA concluded that air pollution contributes 50 percent of the chromium and 99 percent of the lead pollution in the bay.[76]

Wastewater Treatment Plants

Many sewage treatment plants have implemented pollution reduction programs and upgraded treatment systems to significantly reduce the pollution they discharge into the bay. According to the Santa Monica Bay Restoration Commission, "since the early 1970s, the loading of seven heavy metals has decreased by between 67 and 99 percent and the loading of total suspended solids has decreased by more than 80 percent. As a result, impaired ocean bottom habitat near the discharge outfalls has shown signs of recovery."[77] While this progress is worth noting, contamination from wastewater treatment plants remains a significant source of pollution. The Los Angeles Regional Water Board currently permits seven major facilities to discharge pollution the bay. In addition, 160 smaller industrial and commercial facilities currently discharge into the bay.[78] During dry weather periods, it is estimated that major wastewater treatment facilities contribute 84 percent of the nutrient pollution entering the Los Angeles River, the major tributary to the bay.[79]

Sewage Spills

In the late 1980's, several sewage spills occurred in Santa Monica Bay that forced popular beaches to close.[81] Much has since been done by the city of Los Angeles to reduce spills and improve overall sewage treatment, but such spills remain a concern. According to the 2004-2005 'Annual Beach Report Card' issued by Heal the Bay, in 2004-2005 approximately 2.5 million gallons of sewage spilled into Los Angeles County waterways. Much of this pollution ended up in Santa Monica Bay.[82]

Septic Systems

Septic systems are used in areas surrounding the bay that are not served by sewage treatment plants. Existing state regulations are inadequate to protect against leakage of bacteria, nutrients and other pollutants from these facilities. Beyond review of initial plans, the state provides no routine oversight or monitoring to ensure that the systems are operating properly.[83]

Habitat Destruction

Development of the Ballona Wetlands

Approximately 95 percent of Santa Monica Bay's historical wetlands have been destroyed.[84] As a result, Santa Monica Bay has lost much of its natural filtration system that can keep many toxic contaminants out of its waters. One of the last remaining swaths of wetlands in the region – the Ballona Wetlands – is also now at risk. In an effort to build a high-density housing development, Playa Vista is building homes on approximately 150 acres of wetlands habitat that once stretched along the coast. In 2003,

The diversion of stormwater to local wastewater treatment plants allows for the removal of many dangerous metals and other toxic chemicals from discharges before they reach the bay.

A family visits Santa Monica Bay (© iStockphoto International)

the State of California acquired more than 620 acres of the site in an effort to encourage the preservation of the remaining wetlands. Despite this effort, Playa Vista now plans to build homes on more than 250 remaining acres of the wetlands. The loss of more of the wetlands would add to the already devastating destruction of the once-vast network of coastal wetlands that helped protect the quality of Santa Monica Bay from polluted runoff.

Deterioration of Lagoons

In addition to the Ballona Wetlands, coastal habitat such as Malibu Lagoon, Topanga Lagoon and Zuma Lagoon can provide essential coastal habitat. Despite their importance, many lagoons are strained by pollution and development pressure. Malibu Lagoon and its associated creek, for example, provides habitat to many plant and animal species, including Steelhead trout and the Brown pelican. Stressors such as urban runoff, loss of habitat and invasive species threaten to further degrade this important habitat.[85]

Recommendations for Strong Santa Monica Bay Cleanup Plans

In an effort to address the major pollution problems confronting Santa Monica Bay, the Los Angeles Regional Water Board has drafted several strong cleanup plans. The cleanup plan for the Los Angeles River, a major tributary to Santa Monica Bay, for example, requires that cities dramatically reduce trash pollution entering the waterway within the next decade.[86] Subsequent cleanup plans issued by the board should require additional measures—from specific, numeric stormwater pollution limits to air pollution reductions—to restore the bay to health.

Stop New Pollution of the Bay

Improve Infrastructure

Several types of infrastructure improvements can reduce levels of stormwater pollution that reach Santa Monica Bay. The diversion

of stormwater to local wastewater treatment plants allows for the removal of many dangerous metals and other toxic chemicals from discharges before they reach the bay. In 2004, Los Angeles voters passed Proposition O by a large margin that will allow for the purchase of $500 million in bonds in part to go toward infrastructure improvements such as diversions of stormwater to wastewater treatment plants. The city of Los Angeles and the county of Los Angeles have begun construction of such diversions to carry stormwater to Hyperion Wastewater Treatment Plant.[87] In addition, communities can add catch basins and grease filters along storm drains in order to reduce the levels of contamination that enter the waste stream in the first place. Local governments can also convert nonpermeable surfaces along stormwater corridors to green spaces to allow for water to percolate into the ground, rather than wash uninhibited into storm drains.

Issue Strong Clean Water Permits

In 2001, the California Supreme Court ruled that regional water boards can restrict stormwater pollution in the same way they restrict pollution from other sources. As such, the ruling further clarified that the Los Angeles Regional Water Board can establish numeric pollution limits in clean water permits for stormwater pollution that runs into Santa Monica Bay. As part of cleanup plans for Santa Monica Bay, the Los Angeles Regional Water Board should require compliance with such numeric limits on stormwater pollution for municipalities, construction sites and industrial facilities. Required to comply with numeric effluent limitations that can be easily enforced, municipalities will be much more likely to adopt aggressive ordinances or mobilize public support for large structural improvements; industrial facilities will be much more likely to adopt pollution prevention measures; and construction sites will be much more likely to curb pollution that runs from project sites.

Enforce Existing Pollution Reduction Requirements

At a minimum, all cleanup plans for the Santa Monica Bay adopted by the Los Angeles Regional Water Board should commit to mandatory penalties for violations of pollution reduction requirements and outline specific inspection schedules to ensure compliance.

Pass Local City Ordinances to Prevent Pollution

Reductions in the amount of waste and litter generated by cities surrounding Santa Monica Bay could also reduce the threat that urban runoff poses to water quality in the bay. Plastic bags and foam containers litter the waterways that flow into Santa Monica Bay and pose a threat to wildlife. Countries such as Ireland have imposed fees on plastic bags that have succeeded in cutting the use of plastic bags by 90 percent.[88] In March 2005, the city of Malibu banned the use of most foam food containers to reduce pollution on the beach. These pollution prevention measures can be replicated by the numerous municipalities that discharge stormwater into Santa Monica Bay and should be encouraged in cleanup plans drafted by the Los Angeles Regional Water Board.

Fund Sewage System Upgrades

While sewage spills still pose a threat to the quality of Santa Monica Bay and other coastal ecosystems, a recent federal budget proposal would have eliminated millions of dollars in funding for sewage system upgrades in California.[89] This proposal was rejected but may resurface in the future. State cleanup plans should encourage the federal government to maintain funding for sewage system infrastructure improvements that will help prevent sewage spills that threaten public health and wildlife.

Reduce Air Pollution

To reduce the deposit of pollutants from the air into Santa Monica Bay, the Los Angeles Regional Water Board should work

with California agencies charged with protecting the state's air quality—such as the South Coast Air Quality Management District and the California Air Resources Board—to reduce the volume of pollution emitted from both stationary sources and vehicles in California. Such reductions will not only benefit water quality in Santa Monica Bay, they will also reduce the health impacts of air pollution.

Restore Habitat

The preservation and restoration of land that can act as a natural barrier and filter to runoff should also be a priority for state cleanup plans for Santa Monica Bay. Despite the importance of the areas few remaining wetlands to water quality, the developer Playa Vista plans to develop more than one hundred acres of the last remaining significant swath wetlands in the Los Angeles region. State cleanup plans should discourage this development to protect water quality and recommend genuine stewardship for the wetlands by the appropriate state agencies. In addition, state cleanup plans should encourage the restoration of coastal lagoons on the shores of Santa Monica Bay.

Conclusion

The Clean Water Act TMDL cleanup program provides an opportunity to advance numerous measures to fully restore the health of Santa Monica Bay. Cleanup plans already drafted for Santa Monica Bay require local cities to dramatically reduce trash pollution that flows into the bay from tributaries, direct polluted runoff to local wastewater treatment plants and reduce toxic metal pollution. In order to fully restore Santa Monica Bay to health, reduce urban runoff, air pollution deposition, and wastewater pollution that continue to pollute the bay, cleanup plans should issue strong clean water permits that hold stormwater pollution to the same standards as other types of pollution, work with air quality agencies to reduce the emission of toxic chemicals into the region's air, encourage federal funding for sewage system upgrades, support genuine restoration and stewardship efforts of remaining wetlands and lagoons on the coast, and strengthen enforcement of existing pollution reduction requirements.

Clean Water Success Story:
Cleaning up Copper Pollution in the Shelter Island Yacht Basin

Created after a 1950's dredging program expanded the entrance channel to San Diego Bay, Shelter Island Yacht Basin is known as the 'Gateway to the Port of San Diego.'[90] The waters of the island are primarily known as the home of the region's yachting and sportfishing industry. The local San Diego Yacht Club won the coveted America Cup in 1987, often cited as the oldest trophy in sport.[91]

While the boats of Shelter Island Yacht Basin have made it famous, they are also responsible for pollution of its waters with toxic copper contamination. In extremely small concentrations (less than three drops of copper in an Olympic-sized swimming pool), copper can poison small animals like fish, clams and starfish that live in the ocean.[92] Despite this toxicity, a copper-containing compound is added to the paint used to coat the bottoms of many boats in the marina. Used to stop the growth of any algae or bacteria, this copper eventually leaks from boat hulls into its surrounding waters.

Testing completed in 1994 and in 2000 documented copper concentrations in the waters of Shelter Island Yacht Basin 2-3 times higher than federal safety standards to protect marine life.[93] Studies conducted by the San Diego Regional Water Board estimate that 98 percent of this pollution comes from the copper-containing paint used to coat the bottom of boats, while the remaining 2 percent originates from urban runoff and air pollution.[94]

A sailboat near Shelter Island Yacht Basin in San Diego Bay

In order to clean up copper pollution in the Shelter Island Yacht Basin, in 2005 the San Diego Regional Water Board required boat-owners in the Shelter Island Marina to stop using toxic copper-containing paint

to coat the bottom of their boats and switch to non-toxic alternatives within 15 years.[95]

The plan also required the city of San Diego to tighten its copper pollution prevention programs to reduce levels of copper pollution discharged into the waterway through stormwater runoff.

This strong cleanup plan was the first in California to require private boat owners to adopt specific copper pollution reduction measures as part of a TMDL. It sets out a reasonable timetable that allows boat owners to gradually make this switch and sets out interim reduction targets that will lead to the full phase-out of the toxic paints. In addition, the plan recognizes that while urban runoff is not the major source of copper pollution in the bay, sources of new copper pollution into the waterway, however small, must be curtailed.

In order to clean up copper pollution of the Shelter Island Yacht Basin, in 2005 the San Diego Regional Water Board required boat-owners in the Shelter Island Marina to stop using toxic copper-containing paint to coat the bottom of their boats and switch to non-toxic alternatives within 15 years.

Waterway Profiles: The Rivers

The Sacramento River

Summary of Cleanup Plans

The Sacramento River is polluted with agricultural waste and legacy mercury contamination from mining operations. Low flows and the destruction of habitat make these pollution problems worse.

Sacramento River Cleanup Plans Approved by the State Water Board Require

- U.S. EPA to continue current efforts to limit pollution from Iron Mountain and Sulphur Bank mines
  - o While cleanup of these two major sources of pollution will be a significant achievement, pollution from hundreds of additional mines in the area remains unaddressed
- Orchard growers to submit plans to reduce chlorpyrifos and diazinon pesticide pollution of area waterways and monitor for potential pollution caused by switching to other pesticides
  - o While a step in the right direction, this requirement does not adequately safeguard against increased use of more damaging pesticides

Recommendations for Strong Sacramento River Cleanup Plans

Stop New Pollution

- Issue a strong overall clean water permit that requires significant, measurable and enforceable reductions in agricultural pollution entering the waterway
- Work with the Department of Pesticide Regulation and U.S. EPA to prohibit increased use of dangerous pesticides by agricultural operations and require reductions in the overall use of pesticides

Clean Up Existing Pollution

- Establish a renewed California Superfund program, paid for by polluters, which will clean up mercury contamination leaked from mine sites into the Sacramento River and its tributaries
- Institute a comprehensive program to warn and protect communities from the danger of eating contaminated fish until cleanup is complete

Ensure Sufficient Flows

- Withdraw water rights granted to dam operators that do not keep water healthy enough to support strong fish and other wildlife populations in the river. This should include withdrawing water rights that allow the construction of Auburn Dam and the Peripheral Canal, expansion of Shasta Dam, and increased water exports from the Sacramento-San Joaquin Delta if these projects will decrease water quality in the Sacramento River, its tributaries or its associated estuary
- Work with the California Department of Fish and Game to ensure that existing dams on the Sacramento River and its tributaries are operated in a manner that keeps water healthy enough to sustain downstream fisheries

Restore Habitat

- When feasible, require restoration of lost buffer zones habitat along the banks of the Sacramento River and secure funding for local restoration projects

Overview

The Sacramento River is the longest river in California and flows 382 miles from the steeps of Mount Shasta to San Francisco Bay.[97] The forests lining the waterway house more than 250 species of mammals, fish, amphibians, reptiles, and birds, including 65 classified as species of special concern and 33 species classified as threatened, endangered or extinct.[98] Helping to supply drinking water to 22 million Californians, the river also forms the core of the Central Valley Project that supplies water to about a third of California's annual agricultural production.[99, 100]

The environmental challenges facing the Sacramento River are significant. Once lined by a half million acres of forests, by the 1980's less than two percent of the Sacramento River's forest land remained.[101] Pollution leaked from long inactive and abandoned mines in the region has concentrated in soils on the bottom of the river and its tributaries, threatening wildlife and local communities.[102] Furthermore, agricultural runoff pollution that contains pesticides, fertilizer, and other toxic chemicals threatens aquatic life.[103]

High levels of pollution and increased diversions of water from the area are two potential reasons for a crash in the population of a small fish called the delta smelt, a threatened fish species and an important food source for larger fish.[104] In 2005, levels of delta smelt in the Sacramento-San Joaquin Delta were at their lowest levels ever recorded.[105]

Populations of small fish in the Sacramento-San Joaquin River Delta, called 'Delta Smelt,' are crashing. In 2005, numbers were at their lowest ever recorded.

To seize the current opportunity that the Clean Water Act TMDL program provides to restore the Sacramento River to health, cleanup plans should stop further pollution, clean up existing contamination, ensure sufficient flows and restore habitat. Specifically, the State Water Board and Central Valley Regional Water Board should include a series of straightforward requirements in Sacramento River cleanup plans that require substantial reductions in agricultural pollution and adequately fund the clean up of legacy mining pollution. In addition, the State Water Board should withdraw water rights for proposed dams and diversions that will further degrade water quality and work with the California Department of Fish and Game to ensure that existing dams are operated in a manner that protects downstream fisheries.

Threats to the Health of the Sacramento River

New Pollution

Agricultural Pollution

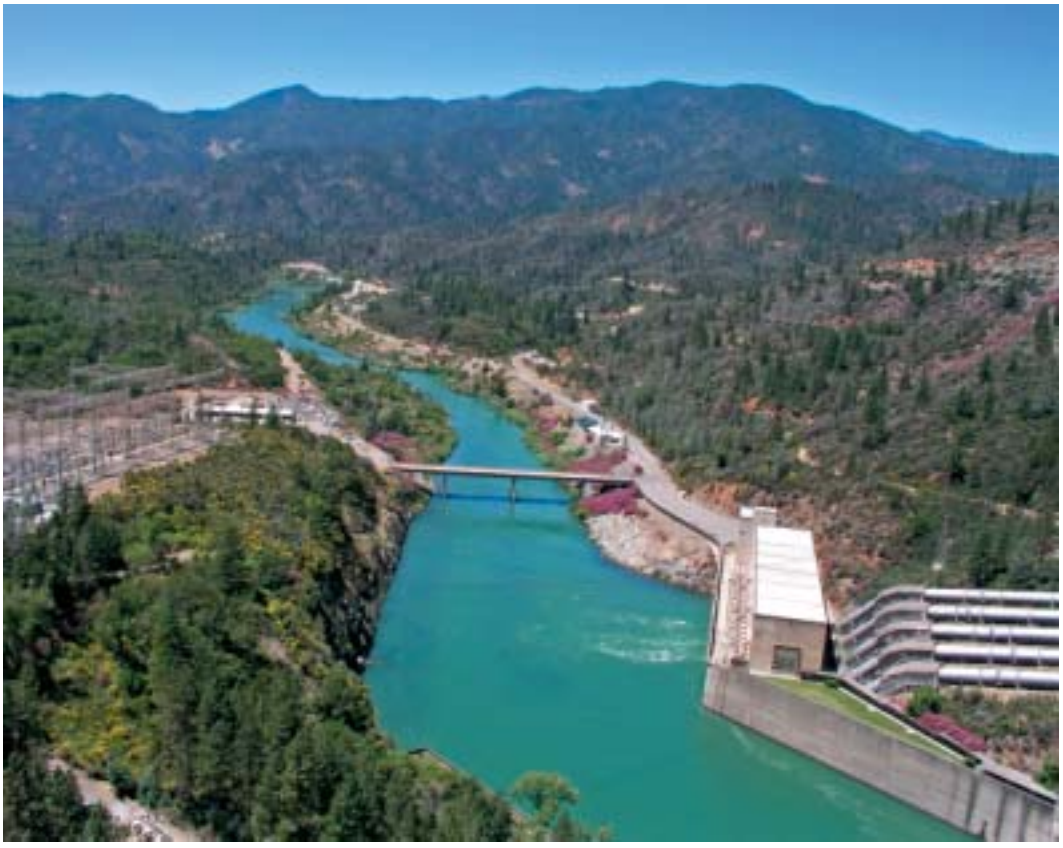
Pesticides use by agricultural operations in the Sacramento Valley is high and occurs as much as 75 percent of the year.[106] Many of these chemicals are carried by rain or pumped through drainage systems into the Sacramento River and its tributaries. Near the city of Sacramento, for example, the Colusa Drain pours irrigation water polluted with rice pesticides and other pollutants from nearby farms into the river.[107]

Due in part to this agricultural pollution, the dangerous pesticides diazinon and chlorpyrifos are detected throughout the waterway and its tributaries.[108] In response to the adverse health and ecological impacts associated with exposure to the chemicals, U.S. EPA ordered the phase out of diazinon and chlorpyrifos use in homes.[109] While the phase out may have decreased levels of

diazinon and chlorpyrifos pollution in the Sacramento River, new pollution was not eliminated because many agricultural operations continue to apply the chemicals to their fields, where they can be washed into the Sacramento River.

In response to restrictions on diazinon and chlorpyrifos use, some agricultural operations are also increasing their use of another class of pesticides called pyrethroids. This class of chemicals may be even more toxic to fish than diazinon and chlorpyrifos pesticides and their full impact on aquatic ecosystems is only beginning to be studied. A 2004 study conducted by University of California scientists detected pyrethroid pesticide contamination in 75 percent of the soils of agricultural waterways tested, in many cases at levels toxic to aquatic life.[110] This pesticide pollution is a suspected factor in the decline of delta smelt populations.[111]

Despite the threat posed to the Sacramento River from agricultural pollution, the Central Valley Regional Water Board and the State Water Board do not hold agricultural operations to the same clean water standards as virtually every other industry in the state. A typical clean water permit issued by regional water boards requires that entities that discharge pollution into waterways comply with requirements to measurably reduce this pollution over time. Instead of issuing this same permit to agricultural operations, in 2004 the Central Valley Regional Water Board adopted weaker regulations, later upheld by the State Water Board, that have not led to any measurable reduction in agricultural pollution of the Sacramento River.[112]



The Sacramento River below Shasta Dam *(© iStockphoto International)*

In 2004, Central Valley Regional Water Board requirements did not result in any measurable reductions in agricultural pollution reaching the Sacramento River

The largest problem with the order adopted by the Central Valley Regional Water Board is a provision that allows individual farmers to form 'coalitions' to comply with pollution reduction requirements. A 2005 analysis conducted by the California Sportfishing Protection Alliance and other environmental groups found that these coalitions have failed to: 1) Comply with the monitoring and reporting provisions of the order; 2) Document specific sources of pollution; and 3) Describe a detailed plan of actions that will be taken to address identified violations.[113] The Central Valley Regional Water Board is legally unable to enforce any requirements to cut water pollution against these coalitions because they are not legally recognized entities. Compounding this enforcement problem, most individual farmers are not required to identify themselves to the Regional Water Board as part of a coalition. It is thus largely impossible for Central Valley Regional Water Board staff to determine who continues to violate discharge requirements and who doesn't. As a result of this flawed policy, coalitions have not measurably reduced agricultural pollution reaching the Sacramento River and its tributaries since the adoption of the Central Valley Regional Water Board's 2004 order.

Urban Runoff

While not as significant a threat to the Sacramento River as to California's coastal areas, urban runoff from the city of Sacramento and its surrounding communities does degrade water quality in the Sacramento River.[114] In response to the phase out of diazinon and chlorpyrifos, some home applicators are increasing their use of pyrethroid pesticides that can be even more dangerous to aquatic ecosystems. This pollution can be carried into local streams by runoff. A recent study conducted by scientists at the University of California detected high levels of pyrethroid pesticide pollution carried into tributary creeks of the Sacramento River by urban runoff.[115] The county of Sacramento estimates that on a typical summer day without rain, an average of 1 million gallons flows through the region's stormwater system and carries these pyrethroid pesticides and other pollutants such as car oil, trash, and garden pesticides into the river.[116]

Existing Pollution

According to the California Department of Toxic Substances Control, more than a century of mining has left hundreds of millions of tons of mining waste throughout the state.[117] Contamination caused by this waste can be found in the upper Sacramento River and its tributaries.

One of the most serious pollution problems created by old mining waste is the contamination of the Sacramento River and its tributaries with mercury, a toxic metal linked to nervous system damage.[118] During the Gold Rush, it is estimated that gold miners used 26 million pounds of mercury to extract gold, which after leaking from the mines made its way to the bottom of waterways in the Central Valley.[119]

The build up of this mercury in the tissues of aquatic life poses a significant health risk to wildlife and to human communities that depend upon the fish for sustenance. [120] Linked to brain damage, mercury pollution in waterways can undergo a chemical transformation called 'methylation' and can then accumulate in the tissue of fish and other wildlife.[121] While state agencies have issued health advisories against eating large

numbers of fish from the Delta, many fishermen who fish regularly in the waters of the Sacramento-San Joaquin Delta are not aware of the warning, can't read signs, or have no option but to fish in order to put food on their tables.[122]

Pollution from the large inactive mining site Iron Mountain Mine, located near Redding, has been largely contained.[123] Though an ongoing source of funding is not guaranteed, cleanup of the Sulphur Bank Mine, which contributes mercury pollution to the Sacramento River, is also underway. Pollution left by most old mines in the region, however, has not been cleaned up because, despite their enormous water quality impacts, no state program exists to comprehensively clean up contamination left by abandoned and orphaned mines in the state's waterways.

Despite the legacy of pollution left by historical mining activity in the state, occasionally mining companies propose adding new sources of contamination to the river. Emgold Mining Corp, responsible for several leaking mine sites in California, is proposing to reopen a mine site in Grass Valley.[124] Using dangerous cyanide technology, the operation would pump wastewater into Wolf Creek, which could then flow into the Sacramento River.[125]

Dams and Diversions

The construction of a series of dams and storage facilities called the Central Valley Project permanently altered the flow of the Sacramento River and decimated fish populations. Consisting of 20 dams and reservoirs, 11 power plants and 500 miles of major canals, the project is one of the world's biggest hydraulic engineering systems and reaches across some 400 miles from the Cascade Mountains near Redding to the Tehachapi mountain range near Bakersfield.[126] Designed to provide water for irrigating crops, the operations of the Central Valley Project have taken a major toll on the health of fish populations in the Sacramento River and other area waterways, with some fish runs declining as much as 80 to 99 percent.[127]

An additional strain on the ecosystem of the Sacramento River and its associated estuary is the massive diversion of water from the Sacramento-San Joaquin Delta to Southern California and other parts of the Central Valley.[128] The massive diversions are cited by local communities as a potential reason for the enormous population declines in delta smelt in the region.[129]

Despite their destructive impact on the ecosystem of the Sacramento River, pressure to build additional dams and increase diversions of the river's water continues. In the wake of Hurricane Katrina, proponents renewed efforts to build a new Auburn Dam near Sacramento. Construction of the dam is unlikely to eliminate the threat of flooding and may harm water quality even further.[130] Proponents of another project called the Peripheral Canal propose to take water from the Sacramento River, bypass the Sacramento-San Joaquin Delta, and dump the water near pumps that can siphon it to other parts of the state. The canal threatens to cut off the supply of water to the Delta and exacerbate water quality problems in the San Francisco Bay.[131]

Yet another proposal would further increase water diversions from the Sacramento-San Joaquin Delta to other parts of the state. Such diversions may further strain the river's ecosystem.

Still another proposal would raise Shasta Dam, located at the head of the Central Valley Project in the Cascade Mountains, to trap even more water behind its walls. The raising of Shasta Dam is opposed by the local Winnemem Wintu, who argue that such an expansion would flood all remaining cultural, historical and sacred sites on a tributary of the river and exacerbate water quality problems.[132] Despite the major implications for the quality of water in the Sacramento River posed by these proposals, the State Water Board has not yet required an assessment of the water quality implications of these projects in cleanup plans.

Destroyed Habitat

Beginning in the second half of the 19th century, most of the forests lining the Sacramento River were uprooted to provide wood for mines in the Sierra, fuel, and the construction of homes. Of the original 500,000 acres of woodland, less than two percent remain.[133] In addition to decimating important habitat for birds and land animals, this logging removed vital shade for the river. Without this shade, the temperatures of the Sacramento River increased, further straining salmon and other fish populations. [134]

Recommendations for Strong Sacramento River Cleanup Plans

While current cleanup plans for the Sacramento River require some controls on diazinon and chlorpyrifos pollution and encourage continued efforts to clean up pollution from two mines, the existing plans do not fully address the bulk of the threats facing the Sacramento River.

Although it is unlikely that we will be able to restore the Sacramento River and its surrounding forests to their full former glory, through a series of straightforward policy measures, significant progress can be made to stop new pollution, clean up existing contamination, prevent expanded dam construction and diversions that will further harm water quality, and restore the river's habitat if the Central Valley Regional Water Board and State Water Board incorporate a series of straightforward measures into their cleanup plans for the Sacramento River.

To significantly reduce the agricultural pollution that threatens the Sacramento River, the Central Valley Regional Water Board should issue the same meaningful limits on pollution to agricultural operations that it issues to every other discharger in the state.

Stop New Pollution

Reduce Agricultural Pollution

To significantly reduce agricultural pollution that threatens the Sacramento River, the Central Valley Regional Water Board should issue the same meaningful limits on pollution from agricultural operations that it issues to every other discharger in the state. At a minimum, the board should issue a clean water permit that requires agricultural operations to accurately monitor for pollution, comply with specific pollution prevention measures, and significantly and demonstrably reduce pollution entering the river. In addition, the permit should commit to specific enforcement and inspection measures that will be used to ensure compliance.

Reduce Overall Pesticide Use

To prevent an escalation in dangerous pyrethroid pesticide pollution in the Sacramento River and its tributaries, the Central Valley Regional Water Board should work with the Department of Pesticide Regulation and U.S. EPA to require overall reductions in pesticide use in homes and agricultural operations.

Clean Up Existing Pollution of the River

The legacy of abandoned and inactive mines remains one of the major pollution challenges facing the Sacramento River. In addition to poisoning ecosystems, mine pollution has created a major public health problem for communities that depend on

fish for subsistence. The major factor stalling the development of a program to clean up the mercury is a lack of funding.

Hundreds of California's mines date back to the Gold Rush, so the parties responsible for creating the contamination are often unknown, out of money, or no longer in existence. The state program that could pay to clean up such sites is out of money. The fund, set up through a 1984 bond measure called the Hazardous Substances Cleanup Bond Act, provided $100 million to begin cleanup of contaminated sites throughout the state.[135] State officials were charged with recouping money from responsible parties to replenish the fund. The pace of money recovery, however, has not kept pace with money spent. As a result, the program is now bankrupt. In order to ensure the cleanup of abandoned mines and other sites around the state, California should set up a cleanup program modeled after the federal Superfund program. The renewed program should be funded through a regulatory fee on sectors such as the mining, oil and chemical industries that are typically responsible for contamination of waterways and groundwater supplies in California. The fund will allow the state to address a major pollution problem in California's most important water bodies without increasing the burden on the state's already strained budget.

At a minimum, no additional mines should be permitted to begin operation in California until the legacy of pollution already left behind by their predecessors is cleaned up.

Ensure Sufficient Flows

Working with the Central Valley Regional Water Board, the State Water Board can ensure that cleanup plans require sufficient water flows to protect water quality in the Sacramento River.

Reallocate existing water rights

Ultimately, the State Water Board possesses the authority to withdraw water rights granted to entities that do not operate dams in a manner that protects downstream water quality or otherwise violates the public trust.[136] In cleanup plans for the Sacramento River, the State Water Board should exercise this authority and withdraw water rights that make possible any new structures such as Auburn Dam or the Peripheral Canal, an expanded Shasta Dam, or increased exports from the Sacramento-San Joaquin Delta if they will further degrade the water quality of the Sacramento River.

Require compliance with existing state law

Another tool available to the State Water Board to clean up waterways was affirmed in a recent federal court ruling that reiterated the need for federal dam projects to comply with state law and operate in a manner that maintains downstream fish populations in good condition.[137] As part of TMDL cleanup plans for the Sacramento River, the State Water Board should commit to working with the California Department of Fish and Game to ensure that, as a part of complying with this ruling, existing Central Valley Project dams and diversions are operated in a way that keeps water quality high enough to sustain healthy fish populations.

Restore Habitat

While wholesale recovery of the habitat that once lined the Sacramento River is unlikely, efforts underway to restore pieces of the Sacramento River's lost forests and wetlands should be encouraged by cleanup plans. The Sacramento River Conservation Area was created by Senate Bill 1086 in 1986 to draft a management plan for the Sacramento River that will "protect, restore and enhance both fisheries and riparian habit." The Sacramento River Conservation Area advocates restoring the river in a manner that will allow the river to follow more of its original flow, releasing some of its energy during periods of heavy rain.[138] The Nature Conservancy also aims to

double the amount of woodland lining the river. 40 percent of this goal has already been achieved.[139] The restoration of such habitat will help create partial natural vegetative buffer zones that will help filter out pollution and maintain water temperature necessary to sustain healthy salmon populations.

Conclusion

Under the Clean Water Act TMDL program, the Central Valley Regional Water Board and the State Water Board are required to formulate cleanup plans for the Sacramento River. This program provides an historic opportunity to return the river to health. On its current path, the river may be left largely polluted with pesticides and other agricultural waste, further strained by increased water diversions, and indefinitely contaminated by mercury.

To shift our course and truly clean up the Sacramento River, plans should stop new pollution, clean up existing contamination, ensure flows sufficient to sustain high water quality, and restore habitat. Specifically, cleanup plans should issue strong clean water permits that require significant and measurable reductions in agricultural pollution. To clean up existing pollution, cleanup plans should also re-establish a comprehensive state Superfund program, paid for by polluters, which will fund remediation of contaminated sites. In addition, through cleanup plans, the State Water Board should withhold water rights for the expansion of Shasta Dam, increased exports of water from the Delta, and the construction of Auburn Dam and the Peripheral Canal if the projects will lead to further degradation of water quality. Finally, where feasible, cleanup plans should fund aggressive programs to restore lost habitat along the waterway.

Summary of Cleanup Plans

In 2002, low flows on the Klamath River decimated fish populations. Despite its precarious ecological state, agricultural pollution and dams continue to fuel the growth of algae that release toxins into river waters. Mining operations in the river can also interfere with the spawning of salmon. Despite these threats, no cleanup plan for the Klamath River itself has yet been finalized by the North Coast Regional Water Board.

Recommendations for Strong Klamath River Cleanup Plans

Stop New Pollution

- Require agricultural water conservation that will reduce the amount of irrigation water containing nitrogen and phosphorous pollution that drains into the waterway
- Ban any mining operation in the Klamath River that degrades water quality

Ensure Sufficient Flows

- Deny state certification for relicensing of dams that degrade water quality

Restore Habitat

- Work with the Oregon Department of Environmental Quality to accelerate restoration of wetlands in Upper Klamath Lake

The Klamath River

Overview

While greatly diminished by decades of misuse and pollution, the Klamath River is still considered by many to be one of California's most beautiful waterways. This winter, the river hosted 1,000 bald eagles-the largest wintering population of bald eagles in the lower 48 states.[140] The waterway supports almost 80 percent of the waterfowl that fly along the Pacific flyway, and salmon still migrate in portions of the river.[141, 142] The local Karuk Tribe and other commercial fishing operations rely upon this fishery to sustain their local economy.

Despite its ecological and economic importance, the Klamath River currently suffers from greatly diminished fish populations. A genetically distinct species of Coho salmon found in the Klamath River is now listed as a federally protected species.[143] Populations of fall Chinook salmon and local Coho salmon are only 8 percent and 1 percent of what they once were.[144] Furthermore, efforts to restore local fish populations suffered a major setback in 2002 when the Klamath River suffered the death of tens of thousands of salmon, one of the worst fish-kills in the nation's history.[145]

Four major sources of pollution threaten the health of the Klamath River. The physical presence of six dams owned by Pacific Corp contributes to blooms of toxic algae and alters water quality. Low volumes of water released through the dams by the U.S. Bureau of Reclamation caused the massive 2002 Klamath River fish-kill. The conversion of wetlands into agricultural land and subsequent drainage of irrigation water increases nitrogen and phosphorous pollution in the waterway, leading to blooms of toxic algae. Finally, unregulated mining operations further pollute river waters.

While several obstacles block the restoration of the Klamath River to health, a set of straightforward measures to stop further pollution, ensure sufficient flows and restore habitat adopted in cleanup plans for the river can restore the waterway's salmon runs and its larger ecosystem. Given the lack of major development in the region that can pollute rivers with runoff, the ability of the Klamath River to regain its health is very viable and more likely than for most other major waterways in the state.

Threats to the Health of the Klamath River

New Pollution

Agricultural Drainage

Nitrogen and phosphorous pollution can fuel blooms of toxic blue-green algae that choke off oxygen supply in the Klamath River and release toxins that endanger human health and aquatic ecosystems.[146] The source of much of this nitrogen and phosphorous pollution is the conversion of large swaths of wetlands in Upper Klamath Lake at the head of the Klamath River to cropland. Once converted, the soils release nitrogen and phosphorous more easily. Irrigation water can then draw the nutrients out of the soil and flush them down the river.[147] Neither the North Coast Regional Water Board nor its counterparts in Oregon, however, have limited the amount of toxic blue-green algae permitted to bloom on the waterway. Furthermore, agricultural operations continue to discharge nutrient-laden irrigation water into the Klamath River, its tributaries and the Upper Klamath Lake.

No limits currently exist on Klamath River toxic blue-green algae that release a poison known to cause liver damage.

Mining

Despite the delicate state of the Klamath River Basin ecosystem, suction dredging mining operations that can degrade water quality and harm salmon spawning grounds operate on the mid-Klamath River.[148] Suction dredging mining draws streambed soils, rocks and other materials through a hose and passes them over a sluice to separate out gold. Waste material is then discharged back into the stream where it can reduce the stability of streams and suffocate valuable salmon spawning beds.[149] Despite their potential harm to water quality, mining operations on the Klamath are not regulated by the North Coast Regional Water Board or the State Water Board.[150]

Dams and Diversions

Low Flows

After over-promising the amount of water it could deliver to agricultural operations in the drought-prone Klamath Basin region, in 2002 the U.S. Bureau of Reclamation did not allow sufficient water to be released into the Klamath River to support healthy fish populations. According to a study conducted by the California Department of Fish and Game, the low flow of water in the river that year caused the death of tens of thousands of fish.[151] Even prior to the massive 2002 fish-kill, local Native American tribes, fishermen and small business owners estimated that the loss of salmon had cost the local economy 3,780 local fishing jobs.[152]

Physical Presence of Dams

In addition to the low volumes of water that flow through them, the physical presence of six dams threatens the health of the waterway. The structures, owned by Pacific Corp, create barriers on the Klamath that block the ability of salmon to follow natural spawning runs. Reservoirs created by the dams also fill with stagnant water that helps breed toxic blue-green algae. The algae, which can release a toxin known to cause liver failure, is present in reservoirs on the Klamath at levels over 100 times what the World Health Organization considers a health risk.[153]

Habitat Destruction

Upper Klamath Lake is naturally eutrophic, which means it contains high concentrations of phosphorous and nitrogen in its water.[154] Since the 1930's, however, scientists have documented the increased frequency of algal blooms linked to higher than natural levels of nitrogen and phosphorous levels in the lake.[155] Experts believe that the conversion of wetlands to cropland is largely responsible for this trend, as it allows oxygen to decompose soils at a faster rate, releasing increased amounts of nitrogen and phosphorous into the lake and consequently the Klamath River.[156]

Recommendations for Strong Klamath River Cleanup Plans

Because the Klamath River is not subject to the pressures that massive urbanization has brought to other major waterways in California, the full restoration of the river is very viable. To put the waterway on the road to a clean water future, cleanup plans for the Klamath River should ban mining operations in and along the waterway that further degrade water quality. The State Water Board should also work with the North Coast Regional Water Board to deny state certification for relicensing of Pacific Corp's dams unless they will be operated in a manner that fully protects downstream water quality. Plans should also require aggressive wetlands restoration, specific limits on toxic algae allowed to bloom in the river, and increases in agricultural water conservation measures to limit the volume of pollutant-laden irrigation that flows into the river.

Upper Klamath Lake at sunset (© iStockphoto International)

Prevent Further Pollution of the River

Require Agricultural Water Conservation

The North Coast Regional Water Board should issue a clean water permit that requires agricultural operations to adopt water conservation measures to reduce the volume of agricultural drainage released into the Klamath River and its tributaries. Less agricultural drainage means fewer nutrients flowing into the Klamath River that contribute to blooms of toxic blue-green algae. Methods to conserve water could include changing crop types, adopting more efficient irrigation methods, rotating crops and fallowing land. Increased water conservation will also have the added benefit of reducing demand for water diversions from the river.

Stop Destructive Mining Practices

As part of cleanup plans for the Klamath River, the North Coast Regional Water Board should issue immediate 'Cease and Desist Orders' against mining operations on the Klamath that harm water quality.

Ensure Sufficient Flows

Deny state certification for dams that degrade water quality

All six Pacific Corp dams on the Klamath River and its tributaries are now up for relicensing by the Federal Energy Regulatory Commission. The complete removal of the dams would help prevent blooms of toxic algae that contaminate the river and choke off oxygen supplies in the waterway. Because Pacific Corp's Klamath River powerhouses account for only 2 percent of the company's total energy production, the California Energy Commission has concluded that removal of one or more of the dams on the Klamath is a viable alternative.[157, 158] Pacific Corp, however, has thus far refused to consider the option of dam removal. In the face of this reluctance, the State Water Board should exercise its authority under Section 401 of the Clean Water Act and, as part of a cleanup plan for the Klamath, deny certification for relicensing of the Pacific Corp dams, unless they can be operated in a manner that

The State Water Board should withhold certification for relicensing of Pacific Corp's Klamath River Dams, unless they can be operated in a manner that protects downstream water quality.

fully protects downstream water quality in the Klamath River.[159] The State Water Board should also urge Pacific Corp to consider the water quality benefits of dam removal.

Restore Habitat

Restoring the wetlands of the Klamath River and Upper Klamath Lake is essential to improving water quality in the waterway and ensuring an abundance of habitat for wildlife. An early report by the Klamath River Basin Fisheries Restoration Task Force lists a series of priority habitat restoration projects.[160] Cleanup plans for the Klamath should encourage funding for these recommendations, with a special focus on restoring wetlands in the Upper Klamath Lake Basin.

Conclusion

On our current path, the Klamath River is in danger of losing its salmon runs and remaining polluted with toxic algae that can cause liver damage. Due to the lack of development along its banks, however, full restoration of the river is very viable. With strong cleanup plans that stop new pollution, withhold certification for dams if they deteriorate water quality, aggressively support wetlands restoration, require water conservation measures to reduce nutrient pollution, and ban mining operations in the river that will further degrade water quality, the river can be brought back to health. Such a restoration will not only resuscitate a precious ecosystem, it will also restore the culture and economic health of the Karuk people.

The San Joaquin River

Summary of Cleanup Plans

Agricultural waste, low flows, legacy mining pollution, salt accumulation and the destruction of habitat all contribute to the degradation of the San Joaquin River.

San Joaquin River Cleanup Plans Approved by the State Water Board Require

- Continued reductions in ammonia pollution from the city of Stockton that contributes to low oxygen levels in the waterway
- Select agricultural operations to reduce the selenium pollution they discharge into the river
    - o While an important step forward, this requirement does not extend to all agricultural operations discharging selenium into the river
- Reduced discharge of salt pollution in the river near Vernalis from agricultural operations
    - o While an important step forward, this requirement does not protect the entire river from salt pollution
- Orchard growers to submit plans to reduce chlorpyrifos and diazinon pesticide pollution and monitor for potential pollution caused by alternative pesticide use
    - o While a step in the right direction, the requirements do not adequately safeguard against increased use of more damaging pesticides

Recommendations for Strong San Joaquin River Cleanup Plans

Stop New Pollution

- Require *all* farming operations that pollute the San Joaquin River to reduce selenium, salt, and additional chemical pollution into the river
- Issue a strong clean water permit that requires significant, measurable and enforceable reductions in agricultural pollution entering the waterway
- Work with the Department of Pesticide Regulation and U.S. EPA to require reductions in the overall use of pesticides in agricultural operations and households

Clean Up Existing Contamination

- Establish a renewed California Superfund program, paid for by polluters, which will clean up mercury contamination leaked from mine sites in the San Joaquin and its tributaries
- Institute a comprehensive program to warn and protect communities from the danger of eating contaminated fish until cleanup is complete

Ensure Sufficient Flows

- Work with the California Department of Fish and Game to enforce state law that requires Friant Dam to be operated in a manner that protects downstream fisheries
- Withdraw existing water rights for any dam operation that does not safeguard downstream water quality
- Deny state certification for the relicensing of any non-federal dam that further degrades water quality
- Establish limits on salt pollution for the *entire* San Joaquin River and require increased releases of water from Friant Dam to meet these limits
- Implement the Central Valley Regional Water Board recommendation that the State Water Board use its existing water rights authority to raise oxygen levels in the river by addressing issues of insufficient water flow

Restore Habitat

- When feasible, require funding for projects to restore lost habitat and buffer zones along the banks of the river as recommended by the San Joaquin River Conservancy

Overview

The San Joaquin River tumbles from the Sierra Mountains near Yosemite in a rush of fresh snowmelt. From this beginning, the river travels approximately 350 miles to the Sacramento-San Joaquin Delta, draining more than 13,000 square miles of California's Central Valley.[161] A lifeline for the region, the waterway supports a $500 million agricultural industry and anchors a water delivery infrastructure that provides drinking water to 22 million Californians.[162] In addition, the river helps recharge the Sacramento-San Joaquin Delta, an expansive inland estuary that serves as a stopover for millions of migratory birds and is home to more than 500 species of wildlife, 20 of which are endangered.[163] The river and its estuary are also major draws for tourists. Annually, the San Joaquin-Sacramento Delta logs more than 12 million visitor days.[164]

While the San Joaquin remains a major artery, today's river is a small remnant of what it once was. Prior to major diversions that dried up the river in stretches and massive agricultural and urban development that eliminated vast expanses of wetlands and enormous oak forests along its banks, the river once ran thick with enormous Chinook salmon, steelhead and other fish species.[165] As it flooded, the river also helped give life to over 1 million acres of lush wetlands in the San Joaquin Valley that provided critical habitat for hundreds of species.[166] Today, however, the river is reduced to no more than a trickle in many places. Several toxic chemicals are found at high concentrations in its waters and its once grand salmon runs are a thing of the past.

Recent testing of waterways that flow into the San Joaquin River found toxic contamination in 59 percent of tests conducted.

While the challenges to restoring the San Joaquin River to health are daunting, a series of simple measures included in cleanup plans for the waterway will fulfill the statutory obligations of California's water boards and make significant progress toward restoring the river to health.

Threats to the Health of the San Joaquin River

New Pollution

Agricultural Pollution

Drainage

A significant source of pollution in the San Joaquin River is agricultural drainage that is pumped into the river from farming operations in the San Joaquin Valley. Often containing selenium that is toxic to wildlife and salt that poisons agricultural soils, this drainage is so potent it once caused a major die-off of birds at Kesterson Reservoir in the San Joaquin Valley.[167]

Runoff

Another source of toxic chemical pollution in the San Joaquin River is the runoff of pesticides and other farm waste from agricultural operations throughout the region. In 2003, agricultural operations applied more than 27 million kilograms of pesticides in Fresno County alone.[168] Many of these chemicals were carried into the San Joaquin River through routine discharge of irrigation water and by rain. This pollution can have a major impact on the waterway. Limited testing conducted in the last year by the Westside San Joaquin River Coalition, a group of agricultural operations, found toxic contamination in 59 percent of tests conducted.[169] Runoff of farm waste also contributes to the growth of algae that chokes the river near Stockton.[170] Despite this widespread pollution, agricultural

operations are not held to the same clean water standards as every other polluting industry in the state. In 2004 the Central Valley Regional Water Board failed to rectify the situation and adopted regulations that resulted in no measurable decrease in pollution entering the river.[171]

While historically high concentrations of diazinon and chlorpyrifos pesticide pollution may be on a downward trend, the San Joaquin River remains seriously polluted with other types of pesticides. Pollution from another class of pesticides called pyrethroids may now be widespread. These pesticides may be even more toxic to fish than diazinon and chlorpyrifos.

Existing Pollution

Old mines continue to leak mercury pollution into the San Joaquin River. According to University of California, Santa Cruz researchers, old mine sites in the Coast Ranges of California, such as the New Idria mercury mine, leak large amounts of toxic mercury into the waterway each year.[172] In addition, past pollution has accumulated in soils at the bottom of the river and its tributaries. Once in the water, much of the contamination is converted to methylmercury, which can accumulate in fish populations as far downstream as San Francisco Bay and pose a risk to wildlife and communities that eat the fish.[173]

Dams and Diversions

The completion of Friant Dam in 1942 ushered in an era of rapid deterioration for the San Joaquin River.[174] Fueled by depression-era desperation and minimal regard for ecological consequences, the federal Bureau of Reclamation constructed the dam to supply water to a small group of farmers on the east side of the San Joaquin Valley.[175] Six years after the construction of the dam, the federal Bureau of Reclamation began diverting 90 percent of the river's flow through large canals, reducing the flow of 60 miles of river below the dam to a trickle and decimating the river's historic salmon run.[176]

Low flows through Friant Dam have reduced the flow of 60 miles of the San Joaquin River below the dam to a trickle, devastating the river's historic salmon run.

To replace water lost from the diversions and help fuel agriculture on the west side of Friant Dam, the federal Bureau of Reclamation began importing enormous volumes of water from the Sacramento-San Joaquin Delta. This water, however, is highly polluted with salts that poison agricultural soils.[177] Despite the threat that salt pollution poses, the Central Valley Regional Water Board has only limited salt pollution on a portion of the San Joaquin River below Vernalis, and not along the entire waterway. In addition, the State Water Board and Central Valley Regional Water Board have not required that the Bureau of Reclamation release more water from Friant Dam in order to dilute the high salt concentrations in the water in the river upstream of Vernalis.

Friant Dam is only one of dozens of dams that interfere with the natural flow of the San Joaquin River and affect its water quality. The San Joaquin River and its tributaries are blocked by numerous additional dams that decrease flow, put local ecosystems at risk and strain water quality.[178] One such structure is Southern California Edison's Powerhouse No. 4 that operates in the upper reaches of the river and degrades habitat necessary to sustain healthy fish populations.[179] Low flow is also a factor in low levels of oxygen in portions of the river.

Recommendations for Strong San Joaquin River Cleanup Plans

While taking several steps in the right direction, cleanup plans already drafted for the San Joaquin River do not adequately address the range of pollution problems that face the river. Current cleanup plans for the San Joaquin have not measurably reduced levels of agricultural runoff entering the waterway. Furthermore, they do not limit salt pollution along the full length of the river. Plans do not require the cleanup of mercury pollution from old mines that continue to threaten local ecosystems and community health and do not require increased flows from Friant Dam to improve water quality and allow the return of salmon runs.

While restoring the San Joaquin to its former glory may seem fraught with insurmountable obstacles, a set of simple measures included in Central Valley Regional Water Board cleanup plans for the river could bring back its famed salmon runs and clean up the toxic contamination in its waters.

The most important step in drafting strong cleanup plans is to release enough water from Friant Dam. Second, through a strong clean water permit the plan should require significant reductions in agricultural runoff that carries pesticides and nitrogen into the river. Finally, cleanup plans should require that agricultural operations reduce drainage that carries selenium and salt pollution and other toxins into the waterway.

Stop New Pollution

Reduce Agricultural Runoff

To eliminate the agricultural pollution that continues to flow into the San Joaquin River, the Central Valley Regional Water Board should issue the same meaningful limits on agricultural pollution that it issues to every other discharger in the state. At a minimum, the board should issue a clean water permit that requires agricultural operations to demonstrate real reductions in pollution, and commits to enforcement and inspection measures to ensure compliance.

Reduce Agricultural Drainage

In a report entitled "Drainage Without a Drain," the San Francisco Bay Institute presented a series of recommendations to significantly reduce toxic farm drainage containing selenium, salt, and other chemical pollution.[180] These recommendations included reducing the volume of irrigation water used to water crops, reusing drainage instead of disposing of it, and retiring lands that are already impaired by drainage. The report highlighted two cases in which farmers at the Grassland Bypass Project and Red Rock Ranch successfully used such techniques to dramatically reduce farm drainage pollution into the San Joaquin River. Cleanup plans adopted by the Central Valley Regional Water Board should extend these requirements to all agricultural operations that pollute the San Joaquin River with toxic drainage.

Reduce Overall Pesticide Use

To prevent an escalation in dangerous pyrethroid pesticide pollution in the San

By reducing the volume of irrigation water used to water crops, reusing drainage instead of disposing it, and retiring lands already impaired by drainage, toxic farm drainage containing selenium and salt pollution can be decreased by 90 percent.

A pair of rafts on the Merced River, a major tributary of the San Joaquin River
(© iStockphoto International)

Joaquin River and its tributaries, as part of cleanup plans for the San Joaquin River the Central Valley Regional Water Board should work with the Department of Pesticide Regulation and U.S. EPA to require overall reductions in pesticide use in homes and agricultural operations.

Clean Up Existing Pollution

Mining pollution is a significant challenge facing the San Joaquin River. As described in the preceding profile of the Sacramento River, the state program that is supposed to pay for cleanup of such sites is out of money. In order to ensure that pollution from mines around the San Joaquin River is cleaned up, the state should set up a renewed California Superfund program. The program should be funded by industries that are typically responsible for contamination of waterways and groundwater supplies in California.

Ensure Sufficient Flow

The most important step in restoring the San Joaquin River is to return water to its channel.

Comply with Existing State Law

Recognizing the importance of increasing flows from Friant Dam to restoring the health of the San Joaquin River, a 16 year court battle spearheaded by the Natural Resources Defense Council (NRDC) and 13 other conservation and fishing groups argued that the low flows from Friant Dam and the subsequent destruction of the river's salmon run violate a California law that requires that all dams release enough water to maintain historic fisheries in "good condition."[181] Studies prepared by the environmental coalition indicate that the U.S. Bureau of Reclamation, the operator of the dam, can both comply with this state law and maintain the viability of farms on the east side of the dam.[182] In 2004, a federal court agreed and ruled that U.S. Bureau of Reclamation must comply with state law and ordered a new trial, involving environmentalists, the federal government and Friant Dam water users, to decide how to restore the river's flow in order to support a healthy downstream fishery.[183] As of December 2005, the parties had agreed to postpone the trial in order to hammer out

an agreement that could at last restore the river's fisheries to health.

Reallocate Existing Water Rights

In the wake of a 1983 California Supreme Court ruling, the State Water Board can also reallocate existing water rights or refuse to issue new water rights to any dam operator that fails to protect the health of a waterway.[184] The state should exercise this authority in Clean Water Act cleanup plans for the San Joaquin River.

The cleanup plan to restore adequate levels of oxygen in the San Joaquin River took a step toward integrating consideration of water flow in a cleanup plan in asking the state water board to "consider amending current water rights permits for activities that reduce flow... to require that their impacts on excess oxygen demand be evaluated and reduced in coordination with those responsible for other contributing factors." The state water board should pursue this recommendation and require increased flows to raise levels of oxygen in the river.

Limit Salt Pollution for Entire River

To protect the soils of the San Joaquin Valley from poisonous salt pollution, the Central Valley Regional Water Board should set an overall limit on salt pollution for the entire San Joaquin River. After setting this limit, the State Water Board should work with the Central Valley Regional Water Board to require increased flows of water from Friant Dam that will lower concentrations of salt in the river.

Deny Certification for Dam Relicensing

Under the Clean Water Act, the State Water Board has the power to deny certification for any proposal to relicense a non-federal the dam if its continued operation will harm downstream water quality.[185] As part of cleanup plans for the San Joaquin River, the State Water Board should exercise this authority and deny certification for the relicensing of dams that further harm downstream water quality.

Restore Habitat

While restoring the millions of acres of wetlands that once lined the San Joaquin River is unlikely, buffer zones of vegetation that line the waterway, filter out pollution before it reaches the river and provide habitat for healthy ecosystems can be significantly restored. In 1993, the California Legislature created the San Joaquin River Conservancy to help make this vision a reality. The goal of the conservancy is to implement a master plan for a San Joaquin River Parkway that would create a 22-mile wildlife corridor along a stretch of the river below Friant Dam.[186] In addition, SB 350 (Machado), introduced in 2005, would allocate $9,160,000 to conduct studies into future habitat restoration projects around the lower portion of the river. Cleanup plans adopted by the Central Valley Regional Water Board should encourage further funding for such habitat restoration projects.

Conclusion

The San Joaquin River is a lifeline for Californians. After decades of restricted flow and unrestricted pollution, the waterway is a shadow of its former self. Current cleanup plans do not do enough to seize the historic opportunity presented by the Clean Water Act TMDL program to restore the health of the San Joaquin. In order to put the river on the path to restoration, legally mandated cleanup plans drafted by the Central Valley Regional Water Board in the next decade should require significant, measurable and enforceable reductions in agricultural pollution, ensure flow sufficient to restore fish populations and maintain high water quality, reduce drainage, and establish a fund to clean up mine pollution.

Clean Water Success Story:
Cleaning Up Dirt Pollution of the Garcia River

Surrounded by acres of forest and running through the steep mountains of Mendocino County to the Pacific Ocean, the Garcia River was once home to teeming populations of steelhead, Coho, Chinook and Pink salmon that battled the waters upstream each year in order to spawn.[187] Despite this rich heritage, the salmon fishery is now down to less than 5 percent of what it was less than 30 years ago.[188]

A major reason for this decline is the pollution of the Garcia River with sediment —dirt washed into the river by logging-related road building, the destruction of native habitat, and other damaging activities. Sediment pollution is a major threat to fish populations because it can alter the flow of streams and cover the natural spawning and rearing habitat of salmon.[189]

The cleanup plan for dirt pollution in the Garcia River, one of the first in the state to require real reductions in pollution caused by runoff, takes several significant steps toward reducing sediment pollution in the river. First, the plan requires individual landowners to determine the sources of sediment pollution coming from their lands and then develop specific strategies to cut pollution. Some of the strategies encouraged by the board include stabilizing roads prone to erosion, maintaining trees and other flora that line the river's edge, and restricting winter logging operations. The plan also requires property owners to meet a clear schedule and clear targets for pollution reduction.[190] Property owners that do not formulate their own plan must adhere to a state plan or cease pollution immediately.

A salmon fights its way upstream during its annual spawning run
(© iStockphoto International)

Drafted in 1997, and finally approved in 2002, implementation of the cleanup plan for dirt pollution in the river already has resulted in some recovery. Local activists

and the Department of Fish and Game documented the return of Pink salmon to the waterway and Department of Fish and Game biologists have discovered returned Coho salmon in four major Garcia River tributaries.[191] The river is doing so well that experts now propose reintroducing Chinook salmon, now extinct in the Garcia, to the river by planting similar strains from nearby watersheds.[192]

Local advocates believe that the North Coast Regional Water Board cleanup plan for dirt pollution is in large part responsible for the turnaround. Advocates believe that the plan spurred water quality reforms by local landowners and agencies in the mid 1990's, resulting in improvements in the river's ecosystem, riverside habitat, and general forest conditions in just a short 10-year period.

After implementation of the cleanup plan for dirt pollution, once-extinct Pink salmon have returned to the Garcia River and Coho salmon have been found in four major tributaries.

Waterway Profiles: The Lakes

Clear Lake

Summary of Cleanup Plans

Clear Lake is polluted with mercury that seeps from an inactive mine on its banks. Nutrient pollution fuels the growth of algae and habitat destruction exacerbates the problem.

Clear Lake Cleanup Plans Approved by the State Water Board Require

- U.S. EPA to continue existing measures to stop leakage of mercury from Sulphur Bank Mine
  - o While an important step, the plan does not guarantee permanent funding for cleanup of the mine or address potential mercury contamination of the lake from other sources

Recommendations for Strong Clear Lake Cleanup Plans

Stop New Pollution

- Stop pollution from septic systems

Clean Up Existing Pollution

- Establish a renewed California Superfund Program to guarantee ongoing funding for cleanup of Sulphur Bank Mine

Restore Habitat

- When feasible, require funding of local efforts to restore wetlands lining the lake

Despite its designation as a federal Superfund site 15 years ago, comprehensive clean up of the mercury pollution created by Sulphur Bank Mine has not yet begun.

Overview

About 100 miles north of San Francisco, in a pocket of the Coastal Ranges, lays Clear Lake, the largest freshwater lake in California.[193] Formed between two and three million years ago, with a recently active volcano on its banks, many geologists speculate that Clear Lake is the oldest lake in North America.[194] Within its basin lives an abundance of wildlife. Known as the 'Bass Capitol of the West,' the lake supports large populations of bass, crappie, bluegill, carp and catfish.[195] Pelicans, bald eagles, blue herons and egrets also make their homes by the lake, as do mountain lion, deer, bear and other animals.[196]

For more than 11,000 years, the Pomo Indians have lived alongside the birds and animals of Clear Lake.[197] Fishing from its waters and using its reeds to construct houses, sew clothing and build boats, the lake provided everything the tribes needed. In 1842, however, the Elem Colony, one of the Pomo tribes living on the shores of the lake, was shattered by an unprovoked massacre of the tribe. The massacre led to the renaming of the island near the northern shore of the lake as Bloody Hill, a name that remains today.[198]

Compounding this historic mistreatment, today the inactive Sulphur Bank Mine continues to leak toxic chemicals such as mercury into Clear Lake, causing a buildup of contamination in fish that prevents the local Pomo colony from pursuing their traditional way of life.

In addition, leaking septic tanks and the destruction of wetlands that line the lake, likely contribute nutrient pollution that can fuel algae blooms that choke the lake of oxygen.

While the pollution facing Clear Lake poses a major obstacle to cleaning up the waterway, the lake can be returned to health with a series of measures in cleanup plans that establish a new California Superfund program, stop septic tank pollution and where feasible, require the restoration of lost habitat that once lined the lake.

Threats to the Health of Clear Lake

New Pollution

Major algae blooms largely caused by nutrient pollution of Clear Lake often choke its surface with a thick, green scum.[199] While local water officials aren't certain where the nutrients are coming from, local residents suspect that septic tanks located close to the lake's shores and upstream vineyards that apply phosphorus-containing fertilizer contribute to the problem.[200]

Existing Pollution

In 1874, the California Borax Company began mining the area around Clear Lake for mercury—a metal invaluable for its ability to extract gold during the days of the California Gold Rush. Using Chinese laborers who were often mistreated, the operation quickly became one of the largest and most profitable mercury mines in the state.[201] After almost one hundred years of extracting metals from the region, including more than 4,000 tons of pure mercury,

the last owners of Sulphur Bank Mine—the Bradley Mining Company—closed the site. Lying in its wake was an ecological disaster.

According to U.S. EPA, the Bradley Mining Company left behind approximately 2 million cubic yards of toxic mine waste that extend along 1,300 feet of shoreline on the banks of Clear Lake.[202] From an open-pit mine dug in the late 1920's, mine waste was also pushed directly into the lake, creating major toxic hot spots on the lake bottom. The open-pit mining also left behind a massive pit, about 90-feet deep, that is now filled with an acid mixture so potent that nothing except bacteria can live in it.[203]

In addition to mercury pollution caused by Sulphur Bank Mine, local experts also believe that mercury leaches from soil into tributaries of Clear Lake, and may contribute additional mercury pollution to the lake.

In the 1970's, after reading about elevated levels of mercury in Japanese fish, a state fisheries biologist named Larry Week tested the fish of Clear Lake. To his alarm, he found high levels of mercury in the lake's catfish and bass populations. After follow up testing, in 1986 state officials issued a warning to the Elem Indian Colony and other area residents against eating large volumes of the lake's fish. Today the California EPA warns people not to consume more than one serving of Clear Lake bass in one week. Women of childbearing age and children under 17 are warned not to eat more than one service of the fish once a month.[204] The mercury buildup cost the tribe its major food source and forced members to buy food from nearby towns. It also robbed the tribe of a major source of income as colony members could no longer sell the fish they caught. The contamination also brought substantial economic strain to surrounding communities that rely on the tourism that fishing on Clear Lake generates. Health warnings of mercury in lake fish sent shockwaves through the angler community and as a result tourism dropped precipitously just as the country headed into a recession.

Sample of Clear Lake Pollution Left by Bradley Mining Company

- Approximately 2 million cubic yards of toxic mine waste line 1,300 feet of shoreline
- A 90-foot deep pit on the banks of the lake is filled with an acidic mixture so potent only bacteria can live in it
- Mine waste pushed directly into the lake has created a major toxic hot spot on the lake bottom
- Mercury buildup in lake fish prevents the local Elem Colony from subsisting on the food they have relied upon for more than eleven thousand years

Habitat Destruction

Of the historic 9,000 acres of water-filtering wetlands next to the lake, 7,000 have been destroyed by humans.[205] The destruction of the wetlands that acted as a natural buffer against pollution carried into the lake by runoff has resulted in increased levels of nutrient contamination in the lake. These nutrients act as food for algae that coat the surface of Clear Lake with an unsightly green scum and choke off life in the waterway.

Recommendations for Strong Clear Lake Cleanup Plans

Restoration of Clear Lake will require a dedicated source of funding to guarantee continued cleanup efforts at Sulphur Bank

Mine. In addition, a strong cleanup plan for the lake should restrict septic tank pollution and require habitat restoration when feasible.

Stop New Pollution

Stop Septic System Pollution

A recent review of septic system regulations conducted by the Santa Monica Bay Restoration Commission determined that current septic system regulations are not sufficient to prevent contamination of nearby waterways. The state currently runs no inspection program for septic systems and regulations are inadequate to prevent leakage.[206] A cleanup plan for Clear Lake should enforce stricter regulations to prevent septic system pollution of Clear Lake. Such a measure would not be unprecedented. In 1991, under pressure to increase protections for the Eagle Lake rainbow trout, the Lahontan Regional Water Board banned the use of septic tanks on the shores of Eagle Lake altogether and required the community to develop an alternative wastewater disposal system that does not pollute the lake.[207]

Clean Up Existing Pollution

Guarantee Funding for Mine Cleanup

While a few stopgap measures have decreased the amount of pollution seeping from Sulphur Bank Mine into Clear Lake, much remains to be done to clean up pollution left by the site. Despite its designation as a federal Superfund site 15 years ago, comprehensive clean up of the mercury pollution created by Sulphur Bank Mine has not yet begun. Mercury and other toxic metals still pollute Clear Lake. The huge

Clear Lake on an early morning (© iStockphoto International)

acid pit and contaminated groundwater still seep toxic mine waste into the lake. Two million cubic yards of mine waste that contain toxic metals like arsenic and mercury remain on its banks and contamination still sits in the water.

In 2005, U.S. EPA proposed its first real cleanup plan for Clear Lake. The plan proposes several alternative scenarios for cleanup. All, however, assume that ultimately the State of California will take over financial responsibility for maintaining cleanup systems installed by U.S. EPA. The state cleanup plan to ensure that Clear Lake is returned to health, however, does not acknowledge its responsibility for securing an ongoing source of cleanup funds and relies too heavily on the U.S. EPA Superfund program to accomplish the bulk of the cleanup.[208] This reliance is problematic in several ways: 1) Due to the Bush administration's refusal to charge polluting companies the fees required to support the program, the federal Superfund program is bankrupt. Funding for any U.S. E.P.A. cleanup must be secured through a yearly tug of war with Congress for a Congressional appropriation. Full, uninterrupted funding of the cleanup effort is threatened in such a climate.[209] 2) Much like its federal counterpart, California's fund to support cleanup efforts like those at Sulphur Bank Mine, known as the Hazardous Substances Cleanup Bond Act, is also bankrupt.

A renewed California Superfund program, which is funded through a fee on polluting industries, could pay the ongoing costs of cleaning up the Sulphur Bank Mine to the state once U.S. EPA's obligations are complete. The fund could also be used to clean up the pollution left by scores of abandoned mines in the area and the sources of mercury that continue to pollute Clear Lake.

Restore Habitat

Local groups have begun efforts to restore wetlands in the region that could provide a natural buffer against soil erosion into the lake. Soil erosion can carry with it algae-breeding nitrogen and phosphorus nutrient pollution. Cleanup plans for Clear Lake should encourage these restoration efforts and require the allocation of dedicated funds when feasible.

Conclusion

On its current path, without a dedicated source of funding for cleanup, Clear Lake is in danger of remaining polluted with mercury and other toxic chemicals. To seize the historic opportunity to restore the Elem Colony's way of life, protect the local economy and restore the ecology of the largest freshwater lake in California, the Central Valley Regional Water Board's cleanup plans for Clear Lake should require a permanent source of funding for remediation of the Sulphur Bank Mine site, modeled after the federal Superfund program. The plan should also stop pollution from septic tanks that line the shore and require, when feasible, the restoration of habitat that once lined the lake.

A California Superfund program, which is funded through a fee on polluting industries, could pay for the ongoing costs of cleaning up the Sulphur Bank Mine once U.S. EPA's obligations are complete.

Lake Tahoe

Summary of Cleanup Plans

Sediment pollution and the growth of microscopic organisms continue to cloud Lake Tahoe. Experts predict that without quick action, the lake will permanently lose its clarity within the next thirty years. A process called Pathway 2007 has been established to assist in drafting cleanup plans for the waterway. Extensive research has been carried out to help formulate the plans, but no cleanup plans for Lake Tahoe have yet been drafted by the Lahontan Regional Water Board.

Recommendations for Strong Lake Tahoe Cleanup Plans

Stop New Pollution

- Continue existing efforts to curb stormwater pollution of the lake
- Ban expanded lakeshore development that will increase stormwater pollution
- Enact measures to further limit streambed erosion from the Upper Truckee River, a major contributor of sediment pollution that clouds the lake
- Require measures to clean up local air pollution, such as the conversion of all buses to non-diesel fuel and increased investment in public transportation to limit air deposition of nitrogen pollution that fuels algae growth in the waterway

Restore Habitat

- When feasible, require restoration of native vegetation and wetlands to prevent streambed erosion and filter out pollution before it reaches lake waters

Overview

California's most famous water body, Lake Tahoe, is one of the world's largest, clearest and deepest alpine lakes.[210] Home to the Washoe Indians for more than 10,000 years, the basin that holds Lake Tahoe was formed several million years ago through a combination of volcanic activity and the movement of glaciers.[211]

Today the lake is known not only for its recreational opportunities, but also as a way for people to escape the cities of the Bay Area and Central Valley and return to nature. Visitors and local residents alike cite the area's beautiful landscape that includes bald eagles, native trout, wildflowers, grassy meadows and towering old growth trees, as the lake's most precious resource. The beauty and recreational development around Lake Tahoe draws 23 million visitor days each year, employs 20,000 people in the region and supports a billion dollar economy.[212]

While Lake Tahoe may seem immune to the forces of time, in reality habitat destruction and lingering pollution sources such as urban runoff and air deposition threaten the famed clarity of the lake. In 2000, researchers at the University of California, Davis released a report entitled "The Lake Tahoe Watershed Assessment" that revealed the seriousness of this trend. A key conclusion of the report stated that without strong action within the next decade, the lake will lose its clarity permanently within 30 years.[213] This revelation greatly heightened the sense of urgency around lake restoration and pollution prevention efforts.

Decreasing clarity in Lake Tahoe is caused by fine particle pollution and the growth of microscopic organisms in lake waters, called zooplankton. These sources of pollution, in turn, are caused by three primary factors: 1. Habitat destruction—the destruction of wetlands that lined the lake and its tributaries removed much of nature's ability to filter out fine particles and nutrient pollution that fuel the growth of zooplankton before they reach lake waters. In addition, the loss of native vegetation near local streambeds destabilized much of the area's soils, contributing to the erosion of streambeds in the area and adding sediment pollution to the lake. 2. Urban Runoff—urban runoff exacerbates streambed erosion, carrying nutrients from urban developments that fuel the growth of zooplankton in lake waters. 3. Air pollution – deposition from pollution released by traffic and activities such as burning of wood stoves is a major source of nutrient pollution in the lake as well.

Cleanup plans required under state and federal law offer an historic opportunity to protect the clarity of Lake Tahoe. As part of a process called *Pathway 2007*, the Lahontan Regional Water Board is working with community members and other stakeholders to formulate these cleanup plans. To permanently protect the clarity of Lake Tahoe, cleanup plans adopted by the Lahontan Regional Water Board should contain provisions both to restrict new sources of pollution and restore habitat. With such measures in place, the waterway can be restored to health.

Decreasing clarity in Lake Tahoe is caused by fine particle pollution and the growth of microscopic organisms in lake waters.

The east shore of Lake Tahoe reflects the snow covered peaks that ring the lake (© iStockphoto International)

Threats to the Health of Lake Tahoe

New Pollution

Urban Runoff

Despite being home to some of the strongest clean water permits in the country, urban runoff caused by overdevelopment in the region around Lake Tahoe is a major cause of both particle and nutrient pollution in the waterway. Development reduces the amount of green space available to absorb rainwater before it can wash into streams, thereby increasing the volume of urban runoff that reaches the lake and its tributaries. Paved surfaces in developed areas also speed up the flow of water. This increase in the volume and velocity of runoff exacerbates streambed erosion, depositing particle pollution that clouds the lake. Increased runoff also carries more nitrogen and phosphorous pollution that fuels the growth of microscopic zooplankton into lake waters.

Air Pollution

In addition to urban runoff, air pollution is a major source of nitrogen and phosphorous pollution in the lake. A recent study conducted by the California Air Resources Board found that air pollution contributes more than half of the nitrogen pollution entering Lake Tahoe.[214] Experts believe that most of this contamination is coming from local pollution sources such as vehicles, wood burning and airborne dust.[215]

Habitat Destruction

Native vegetation can hold together the soils of tributaries and prevent them from washing into the lake. Wetlands lining the lake can filter out dirt pollution caused by streambed erosion of Lake Tahoe's tributaries. Despite the importance of native habitat, historical practice has not

To protect the clarity of Lake Tahoe, cleanup plans should deny clean water permits for *any* new or expanded development and only allow redevelopment of previously developed areas.

preserved the local flora to the greatest extent possible. According to the UC Davis Lake Tahoe Study Group, "Urbanization of the basin has eliminated 75 percent of its marshes, 50 percent of its meadows and 35 percent of its stream zone habitat-all crucial elements enabling the lake to cleanse and restore itself."[216]

One of the most significant examples of this destruction was the dredging of a hundred acres of pristine wetland at the confluence of the Upper Truckee River and Lake Tahoe to create a development known as the Tahoe Keys. The Upper Truckee River is Lake Tahoe's largest tributary and largest contributor of sediment pollution to the lake. The wetlands slowed and spread the enormous volumes of water that the river brought to the lake and filtered out much of the dirt it carried. With the destruction of the wetlands, the Upper Truckee now carries much of its eroded sediment directly into the waterway.

Recommendations for Strong Lake Tahoe Cleanup Plans

Stop New Pollution of the Lake

Limit Development

Experts believe impervious coverage is "the most critical element in the land disturbance that has created the basic environmental problems facing the Lake Tahoe basin—water quality degradation, flooding, and soil erosion"[217] Currently, Tahoe planners maintain strict restrictions on development.[218] To protect the clarity of Lake Tahoe from further threat, cleanup plans should deny clean water permits for *any* new or expanded development and only allow redevelopment on previously developed areas.

Reduce Air Pollution

In order to minimize air deposition of nitrogen that can lead to algal growth, cleanup plans for Lake Tahoe should require that the Lahontan Regional Water Board work with state agencies that monitor air quality to issue permits that will limit the local air pollution deposited into the lake. Through such requirements, local municipalities can be compelled to enact clean air measures like converting all local school buses to non-diesel fuel and expanding local public transportation.

Continue Urban Runoff Pollution Controls

The Lake Tahoe region is subject to some of the strongest urban runoff controls in the country. These controls contain numeric pollution limits on polluted runoff running from private homes, businesses and other developments that have significantly reduced levels of contamination reaching the waterway.[219] Even more, however, can be done to further protect the lake. Studies conducted by the Agricultural Research Service indicate that sediment pollution from the Upper Truckee River could be significantly reduced by controlling streambank erosion near the golf course and airport located near its banks.[220]

Restore Habitat

To reduce the erosion of streambeds and filter out nutrient pollution carried into the lake by urban runoff, cleanup plans for Lake Tahoe should require aggressive restoration of streambanks with native vegetation. To date, the Lake Tahoe Conservancy has awarded grants totaling more than $35 million for 71 projects to restore habitat in the area. Additional investment in restoration, however, is needed. Cleanup plans for Lake Tahoe should call for an aggressive funding schedule that will allow public agencies such as the Lake Tahoe Conservancy to purchase land along the lake to protect it from development and restore lost habitat.

In order to minimize air deposition of nitrogen that can lead to algae growth, cleanup plans for Lake Tahoe should require that local air and water quality officials work together to limit the local air pollution that is deposited into the lake.

Conclusion

To seize the historic opportunity provided by the Clean Water Act TMDL program to return Lake Tahoe to a pristine condition, cleanup plans for the lake should require an aggressive program to restore local native habitat, further limit urban runoff and restrict sources of air pollution that deposit contaminants into the lake. With these proper safeguards in place, the lake will remain blue.

Eagle Lake

Summary of Cleanup Plans

The native rainbow trout population of Eagle Lake has lost the ability to reproduce naturally. The waterway is also listed by the Lahontan Regional Water Board as polluted by nutrients that can fuel the growth of algae and choke off oxygen supplies in the lake. No cleanup plan for Eagle Lake, however, has yet been proposed by the local water board.

Recommendations for Strong Eagle Lake Cleanup Plans

Stop New Pollution

- Restrict lakeshore development that will increase runoff pollution and destroy shoreline wetlands that filter pollutants
- Require accelerated efforts to develop alternative wastewater disposal system in lakeshore community

Restore Habitat

- Encourage efforts to restore a naturally-reproducing native rainbow trout population by listing Pine Creek, a major tributary to the lake, as polluted with the invasive Eastern brook trout species
- Remove the non-native fish through environmentally sustainable means

Overview

Named after the bald eagles that reside on its shores, Eagle Lake is considered by many to be Northern California's 'best kept secret and hidden jewel.' Tucked in the northeast corner of California, the lake has changed little through the passage of time, and is the second largest freshwater lake located fully within California.[221] Unlike its well-known sister to the south, Lake Tahoe, Eagle Lake is not known for the welcome it provides. The lake's waters have a high pH—which makes it very difficult for most fish species to survive in its waters.[222] According to researchers at Chico State University, "The wind comes up quickly; the lake can go from a flat calm [lake] to a sea of whitecaps in less than half an hour. So serious is the problem created by the wind that the Lassen County Sheriff maintains a large, seaworthy boat on the lake. Its purpose is largely to patrol the lake after the winds and pick up and tow in smaller boats unable to make it to the marinas in time."[223]

Despite its inhospitable reputation, the Eagle Lake basin supports a teeming community of plants and animals. More than 80 plant species, including brilliant wildflowers, blossom around the lake. More than 200 species of mammals, birds and amphibians live in the basin as well. [224] Visitors can spot several species of bats, white pelicans, swans, deer, bears and even the occasional mountain lion on hikes. In the spring and fall, thousands of migratory birds of all types stop over in the basin, making it a destination for both birders and hunters.[225] Throughout the summer and into the fall, the lake hosts bird species such as grebe, pelicans, cormorants and herons. Osprey ply lake waters for fish in competition with bald and golden eagles.

Eagle Lake, however, is best-known for the Eagle Lake rainbow trout that lives within its waters. The only known trout sub-species that can survive the harsh alkalinity of the lake, the fish is known for its hardiness and cannot be found naturally anywhere else in the world. The presence of the trout draws fishermen from far distances.[226]

Named after the bald eagles that reside on its shores, Eagle Lake is considered by many to be Northern California's "best kept secret and hidden jewel." *(© iStockphoto International)*

Eagle Lake's remoteness has isolated it from much of the environmental degradation that impacts waterways in more populated regions of California. Degradation of Pine Creek, the natural spawning ground for the Eagle Lake rainbow trout, and the introduction of non-native fish species into a lake tributary, however, have inhibited the ability of the trout to reproduce naturally. The lake is also listed as polluted by phosphorous and nitrogen, nutrients that can fuel algal blooms that choke off oxygen in the lake.[227] Increasing pressure for lakeshore development also threatens to bring the water quality problems impacting its sister waterways to the shores of Eagle Lake.

The Clean Water Act TMDL program affords an opportunity to protect Eagle Lake from any further degradation and strengthen protections for the Eagle Lake rainbow trout. By limiting further nitrogen and phosphorous pollution and removing Eastern brook trout from Pine Creek, the health of the lake can be safeguarded.

Threats to the Health of Eagle Lake

New Pollution

Phosphorous and Nitrogen

Prompted by a fish kill in the late 1980's, Eagle Lake is currently listed by the Lahontan Regional Water Board as polluted by phosphorus and nitrogen, chemicals that can lead to the growth of algae that sucks oxygen from lake waters and harms lake ecosystems.[228] The largest housing tract on the lake, Spaulding Tract, is a collection of cabins and house trailers, with a resort and airport nearby. Septic systems of individual homes placed close to shore can leak nitrogen into lake waters. To help guard against future potential fish kills, in 1996 the Lahontan Regional Water Quality Control Board (Lahontan Water Board) ordered the phase out of septic tanks on the lake shore and urged the local community to develop an alternative sewage disposal system. In response to this order, the local community elected to construct a local wastewater treatment plant that would release water to evaporation ponds instead of the lake.[229] This treatment plant has yet to be constructed.

Pressure to Develop

While Eagle Lake has largely escaped many of the pollution problems that afflict its sister waterways throughout the state, increased development around the lake will increase pollution levels. Wetlands that rim the lake act as filters for pollution before it reaches lake waters, and would likely be degraded with significant development of the lakeshore. In addition, the paved surfaces that accompany development would reduce the amount of open space available to absorb runoff before it reaches lake waters.

Habitat Destruction

The primary threat facing Eagle Lake is the collapse of the Eagle Lake rainbow trout's ability to naturally reproduce in the lake's waters. The natural life cycle of the fish requires it to swim through Pine Creek, the major tributary to Eagle Lake.[230] Historically, logging, grazing, railroad construction and road building led to the degradation of Pine Creek to levels insufficient to sustain the trout's migratory swim. The California Department of Fish and Game describes the destruction:

> *"Besides deforesting large chunks of the watershed and creating erosion-prone roads, logging activity in the region resulted in a railroad being built across the Pine Creek drainage, restricting flow of the creek at one point and channelizing the streambed. This situation worsened when State Highway 44 was built parallel to the railroad and forced the stream through several culverts. The combination of culverts and channelized stream created a nearly impassible velocity barrier for the trout. Grazing of livestock has been (and continues to be) a problem because livestock concentrate around the stream. In the lower reaches of the stream (Pine Creek Valley, etc.) most of the riparian vegetation is gone and the wet meadows have been so compacted that they have been largely converted into dry flats dominated by sagebrush. As the result of all these activities acting on the stream for nearly 100 years, the lower creek has cut down into the former meadow 1-2 m and has become more intermittent in flow during the summer, with flows diminishing rapidly in the spring. As a consequence, the stream (especially the key spawning and rearing areas around Stephens Meadow) is nearly inaccessible to spawning adults and contains less habitat for juvenile fish."*[231]

To prevent the complete collapse of the native Eagle Lake rainbow trout population, local community members, business and government agencies formed an advisory group called the Pine Creek Coordinated Resource Management Planning Group (CRMP). A testament to the ability of local investment to restore waterways, CRMP successfully addressed many of the

pollution and degradation issues facing Pine Creek. Among efforts to restore the waterway, Cal Trans redesigned culverts that altered the flow of the creek and threatened local fish populations. [232]

To stop the precipitous declines in the Eagle Lake rainbow trout population, the California Department of Fish and Game initiated a hatchery rearing program that catches the fish as they migrate into Pine Creek in the spring, strips their eggs, and allows them to hatch in distant hatcheries where they are reared for 14 to 18 months. The trout are then returned to the lake.[233]

This hatchery program and restoration of Pine Creek succeeded in averting a short-term threat to the Eagle Lake rainbow trout. The programs, however, do not ensure the long-term survival of the trout. The hatchery system can weaken the genetic hardiness of the trout and threatens to introduce disease and genetic disorders that could wipe out the fish population of the lake.[234] The trout population cannot be considered recovered or stable until it can reproduce naturally.

Another barrier to the natural reproduction of the Eagle Lake rainbow trout is the presence of non-native Eastern Brook trout populations in Pine Creek, a tributary to Eagle Lake and the primary spawning ground for the Eagle Lake rainbow trout. The California Department of Fish and Game planted Eastern brook trout in the major spawning grounds for the Eagle Lake rainbow trout in 1949, after which the non-native species quickly took hold and now out-competes the native rainbow trout population. [235]

Recommendations for Strong Eagle Lake Cleanup Plans

To protect Eagle Lake against further degradation, cleanup plans for the waterway should require accelerated construction of a local wastewater treatment plant, the removal of non-native Eastern brook trout species through environmentally friendly means, restoration of local wetlands habitat, and strengthened restrictions on further development.

Stop New Pollution

Accelerate Construction of Wastewater Treatment Plant

In 1996, the Lahontan Regional Water Quality Control Board ordered Spalding Tract community members to cease use of septic tanks that contributed to phosphorus pollution of Eagle Lake.[236] After nearly a decade of contentious debate within the community, funding sources for the construction of a $10 million wastewater treatment plant have been secured.[237] The Spalding Community Services District should accelerate construction of this treatment plant in order to limit nutrient pollution in the lake.

Restore Habitat

Restoration of wetlands that used to line Eagle Lake will help filter out phosphorus, nitrogen and other pollution before it reaches its waters. The Lahontan Regional Water Board cleanup plan should encourage further restoration of wetlands habitat and restrict lakeshore development that will exacerbate runoff pollution and wetland destruction.

In order to restore a naturally-reproducing population of Eagle Lake rainbow trout to the lake, the Lahontan Regional Water Board should first list Pine Creek as polluted by the invasive Eastern brook trout species and then remove the non-native population from the waterway. Working with the California Department of Fish and Game, the board should explore environmentally friendly options for removal such as increased angling, electrostatic and hand removal.

Conclusion

To ensure the permanent protection of the Eagle Lake rainbow trout, cleanup plans for Eagle Lake should restrict future development that may increase water pollution, require accelerated construction of a local wastewater treatment plant, and rehabilitation of a naturally-reproducing native rainbow trout population in the lake. Such measures will preserve Eagle Lake as a picturesque destination for fishermen and nature enthusiasts for generations to come.

Policy Recommendations

In the next decade, California's water boards are required by federal and state law to create and implement cleanup plans, called 'Total Maximum Daily Loads,' for the state's biggest polluted bays, rivers and lakes. While a few examples of strong cleanup plans for waterways such as the Garcia River and Shelter Island Yacht Basin exist, many of the state's most important cleanup plans are not yet drafted. Furthermore, many of the plans already drafted do not set a good precedent for road maps to a clean water future.

Without a change in direction, cleanup plans may simply enshrine the status quo and miss the historic opportunity to clean up many of California's largest polluted bays, rivers and lakes.

California's State Water Board and Regional Water Boards should shift course. To fulfill their legal mandate, cleanup plans should include a series of straightforward measures that mandate direct dramatic reductions in sources of new pollution such as agricultural and stormwater runoff, require polluting entities to fund a new California Superfund program to clean up existing toxic contamination, compel dam operators to ensure flows sufficient to maintain healthy waterways, and increase funding for habitat restoration. With strong cleanup plans that contain such measures, the state's water boards will seize the historic opportunity to realize a clean water future for California.

Without a change in direction, cleanup plans drafted by the water boards may simply enshrine the status quo and miss the historic opportunity to clean up many of California's largest polluted bays, rivers and lakes.

In 2004, the State Water board adopted a policy entitled "Draft State of California SB469 TMDL Guidance, A Process for Addressing Impaired Water in California" to guide the regional water boards as they draft cleanup plans under the Clean Water Act TMDL program. In its guidance, the State Water Board reiterated the importance of developing implementation plans that will achieve the goals set out by a cleanup plan. According to the policy, an implementation plan in California should include:

- Descriptions of the actions necessary to achieve water quality standards. For TMDLs, they are actions to achieve waste load and load allocations and numeric targets
- Action to resolve key uncertainties and verify key assumptions
- A schedule and key milestones for the actions to be taken
- Monitoring and surveillance to be undertaken to determine compliance with the water quality standards. For TMDLs, this includes tracking and evaluating actions and attainment of wasteload and load allocations and numeric targets[238]

In 2004, the State Water Board also adopted the "Policy for Implementation and Enforcement of the Non Point Source Pollution Control Program." The policy reiterates the ability of California's regional water boards to require polluters to reduce runoff pollution and enforce stormwater pollution reduction requirements against individual polluters.[239]

Both these guidance policies provide a framework for strong cleanup plans and authorize regional water boards to exercise considerable discretion and authority in requiring strong cleanup actions as part of these plans.

Footprints on the beach Santa Monica Bay *(© iStockphoto International)*

Regional water boards should move forward and exercise their full authority under these policies to include many of the aggressive cleanup measures outlined below in their Clean Water Act TMDL cleanup plans. By doing so they will fulfill their legal mandate and seize the historic opportunity to ensure a clean water future for generations to come.

Recommendation One: Acknowledge All Polluted Waterways

Despite the serious threat posed, California's water boards have not recognized Humboldt Bay as polluted with dioxin and Eagle Lake as threatened by invasive species. The first step in fulfilling the goal of the Clean Water Act to clean up all polluted waterways in the state, is to recognize all of the contaminants that impact California's rivers, lakes and bays and include them on the state's official list of impaired waterways.

Recommendation Two: Stop New Pollution

To clean up the waterways profiled in this report, at a minimum California's water boards must require substantial reductions in the amount of new pollution allowed to enter our biggest polluted bays, rivers and lakes. Such measures are not unprecedented. The Lahontan Regional Water Board requires many property owners around Lake Tahoe to adhere to strict numeric pollution limits that limit stormwater runoff pollution in to the lake.[240] In addition, the board is working with the California Air Resources Board to identify measures that will stop the air deposition of contaminants into the lake.[241] To the south, the San Diego Regional Water Board is requiring boat owners that sail in the Shelter Island Yacht Basin to switch to non-toxic paint in order to protect Shelter Island Yacht Basin from copper contamination.[242]

Comprehensive measures to stop new pollution from entering our waterways, however, have not been adopted for many of the largest polluted bays, rivers and lakes in the state. To dramatically reduce the amount of new pollution reaching polluted waterways like the San Joaquin River and San Francisco Bay, all cleanup plans should require strong clean water permits, enforce existing pollution reduction requirements, restrict unmitigated development that contributes to urban runoff, and issue an overall permit that requires significant, measurable reductions in agricultural pollution. Finally, California's water boards should aggressively work with other California agencies to secure necessary reductions in contamination originating from air pollution, septic tanks and pesticide use.

Adopt Strong Clean Water Permits

Hold Stormwater Polluters to the Same Pollution Reduction Standards as Other Polluters

While direct discharges from facilities into waterways such as Santa Monica Bay have significantly decreased in response to pollution reduction requirements mandated by federal and state law, stormwater pollution continues to pose the single largest pollution threat to California's coast. The reason for this continuing threat is weak implementation of stormwater pollution controls that could dramatically reduce pollution caused by urban runoff.

Stormwater permits issued in California under the Clean Water Act have traditionally been weaker than permits issued to direct dischargers. They have not required sources of stormwater pollution to meet strict numeric limits on pollution that guarantee a waterway meets clean water

standards. Instead, stormwater polluters are only required to comply with a vague requirement that they 'try as hard as they can' to reduce stormwater pollution. This approach is difficult to enforce and has not succeeded in significantly curbing stormwater pollution of places like Santa Monica. A 1998 study conducted by U.S. EPA, for example, found that shoreline pollution due to urban runoff in fact *increased* from 55 percent in 1996 to 63 percent in 1998.[243]

In 2001, in a strong effort to reduce stormwater pollution reaching San Diego Bay, the San Diego Regional Water Board issued a new stormwater permit to the County of San Diego and the San Diego Unified Port District that required significant pollution reduction measures. Among these measures, builders of new developments can be required to capture significant amounts of heavy runoff after rainstorms before it can reach local waterways.[244] In justifying the permit, the Regional Water Board argued that it can require stormwater polluters to meet 'water quality standards,' just as it requires 'point source' polluters to do. After a long court battle between the Building Industry Association and the State Water Board, San Diego Baykeeper and the Natural Resources Defense Council, the San Diego Regional Water Board's permit was upheld.[245] The victory in this case clarifies the ability of regional water boards around the state to issue strong permits that hold stormwater pollution to the same reduction requirements as other types of pollution.

Adopt Numeric Pollution Limits in Stormwater Permits

In allowing regional water boards to issue stormwater permits that hold stormwater polluters to the same pollution reduction requirements as other types of pollution, *BIA v. State Water Resources Control Board* also further clarifies the ability of regional water boards to require stormwater polluters to meet the same strict numeric pollution limits historically applied only to facilities that discharge directly into waterways. The ability of the state to establish numeric pollution limits is also outlined in the state's own 'Plan for California's Nonpoint Source Pollution Control Program,' which states that if voluntary programs are ineffective, the state can establish 'effluent' or pollution requirements.[247] The Lahontan Regional Water Quality Control Board has already issued numeric pollution limits in permits designed to stop the runoff of contaminated rainwater into Lake Tahoe.[248]

Current stormwater permits, however, largely do not require these numeric pollution limits. Instead they require municipal, industrial and construction facilities to adopt measures, called 'Best Management Practices,' to reduce the amount of runoff pollution entering local waterways. Best Management Practices include measures such as litter reduction education programs and planting green space along developments to absorb runoff and local ordinances to reduce pollution at the source. Such reduction programs are essential to reducing runoff pollution.

The current mechanism for enforcing BMP requirements is called the 'iterative approach,' where over time permittees report their violations and then strengthen their pollution prevention practices to avoid more violations. Occasionally enforced effectively, the 'iterative approach' sometimes results in real efforts to reduce stormwater pollution. For the most part, however, because compliance determination requires physical inspection of facilities and in-depth evaluation of pollution prevention programs, regional water boards do not have the resources to fully enforce pollution reduction requirements in current permits.

To increase the enforceability of requirements to reduce runoff pollution, cleanup plans should require strict, numeric pollution limits on stormwater. These numeric limits are easily enforceable by water board staff and will provide a real benchmark against which to measure progress in reducing pollution.

Numeric pollution limits for storm water can also galvanize community support.

Humboldt Bay at sunset. *(Photo by Lenny Gonzalez)*

In Los Angeles, faced with numeric requirements to reduce trash pollution in the Los Angeles River, voters approved Proposition O, an initiative that will generate $500 million for water quality improvement measures.[246]

Enforce existing pollution reduction requirements

A basic step in reducing new pollution entering the largest contaminated waterways in the state is to enforce existing pollution reduction requirements. California's track record in enforcing legally mandated pollution reduction requirements is weak. A report released by *Heal the Bay* in 1998, for example, found that out of 9,000 violations of clean water permits in the Los Angeles Region over a seven period, only 14 fines were issued.[249] Subsequent legislation sponsored by the California Public Interest Research Group (CALPIRG) and Environment California has substantially improved enforcement.[250] Much, however, remains to be done. The most recent analysis of enforcement of California water pollution reduction law conducted by the Legislative Analyst's Office (LAO), for example, found that inspections to determine compliance with clean water permits occur infrequently. Specifically, the LAO found that one regional board had conducted only 25 percent of the inspections committed to in its annual work

plan. Another Regional Board had only committed to conduct 70 percent of the NPDES permit inspections required under EPA minimum standards.[251]

Issue a strong overall permit that requires significant reductions in agricultural pollution entering waterways

Agricultural operations in the Central Valley are not required to meet the same pollution reduction requirements that apply to virtually every other industry in California. Under a weak exemption adopted by the Central Valley Regional Water Board in 1982, farms in the Central Valley that are responsible for seriously polluting the San Joaquin and Sacramento rivers with toxic pesticides and chemicals that lead to oxygen-starvation in their waters are not required to meet enforceable pollution reduction requirements. Instead, farmers join 'coalition groups,' which are supposed to test for contamination and reduce pollution. A review of the first year of the 'coalition' program, adopted in 2004, reveals that it has not resulted in any measurable decrease in the amount of agricultural pollution entering waterways. This failure is due to two primary factors: First, the agricultural coalitions are not legally recognized entities, so the Central Valley Regional Water Board cannot enforce pollution reduction requirements against them. Second, most coalitions are not required to identify who makes up their group, so it is impossible for regulators to hold agricultural operations individually accountable for a lack of pollution reduction efforts.

To make real inroads in cleaning up waterways polluted by farm waste, cleanup plans should require that agricultural operations comply with the same pollution reduction requirements as virtually every other industry in the state. Specifically, cleanup plans should require that agricultural operations demonstrate real reductions in pollution, monitor pollution and pay fees to support enforcement of the program. With such a permit, this source of pollution that threatens the largest polluted rivers in the state and the state's most important drinking water supplies can finally be curtailed.

The absence of a strong clean water permit that mandates measurable reductions in agricultural pollution of the San Joaquin and Sacramento rivers is particularly egregious given the range of pollution prevention measures available to reduce the levels of pesticides, nutrients and other agricultural pollution reaching waterways. Such pollution prevention measures include:

Nutrient Management: When too much fertilizer is applied to crops, plants cannot utilize it before it leaches below root level and into groundwater systems. Excessive application can also cause elevated levels of nitrogen and phosphorus in sediment runoff, again because plants are incapable of utilizing the fertilizer. By knowing how much fertilizer a crop needs and discontinuing excessive fertilizer application, fewer contaminants like nitrates, phosphorous and bacteria are able to reach groundwater or open waterways. The practice of nutrient management can reduce nitrogen and phosphorous loses from cropland by 50 to 90 percent.[252]

Integrated Pest Management: Integrated Pest Management, or IPM, is a method of controlling insects, weeds and disease without relying on chemical pesticides that can be washed into nearby waterways. Although pesticides may be used, IPMs attempt to control pests through other methods. Some IPM methods are already used on many farms such as crop rotation, tillage, planting pest resistant plant varieties, and altering planting or harvest dates and may also include the control of pests by the pest's natural enemies. Current pesticide use could be reduced by 40 percent by implementing currently available IPM programs.[253]

Conservation Tillage: The Soil Conservation Service defines conservation tillage as any tillage method that leaves at least 30 percent of soil surface covered with crop

residue after planting. Conservation tillage can reduce soil erosion rates by 40 to 90 percent, and can reduce the amounts of nutrient and pesticide pollution that reach open waters attached to soil particles.

Contour Farming: Contour farming is farming around the slope of the field, rather than farming up and down the slope, and can reduce erosion rates by 50 percent.[254] Like conservation tillage, because contour farming reduces erosion, it also reduces the amount of contaminants reaching open waters attached to soil particles.

Stripcropping: Stripcropping involves arranging a mixture of crops and systematically planting those crops in strips that alternate between row crops (like corn) and close growing crops (like alfalfa).[255] Stripcropping can reduce erosion by as much as 75 percent.[256]

Crop Rotation: Crop rotation varies the type of crop grown on a field from year to year. For example, a farmer may grow corn for several years, and then switch to alfalfa or soy. By periodically planting grass or legumes, erosion can be diminished, and changing crops from year to year can reduce some pests, and the need for pesticides.[257]

Require all agricultural operations to reduce drainage pollution into waterways

In a report entitled "Drainage Without a Drain," the San Francisco Bay Institute presented a series of recommendations that can significantly reduce farm drainage that contains toxic selenium, crop-damaging salts, and other chemicals.[258] These steps include reducing the volume of irrigation water used in watering crops, reusing drainage instead of disposing of it and retiring lands that are already impaired by drainage. The Bay Institute report highlights two cases in which farmers of the Grassland Bypass Project and Red Rock Ranch have successfully used these techniques to dramatically cut farm drainage. Cleanup plans adopted by the Central Valley Regional Water Board should be revised to extend these requirements to all agricultural operations that drain into the state's waterways.

Restrict pollution from septic tanks

A recent review of septic system regulations conducted by the Santa Monica Bay Restoration Commission determined that current septic system regulations are not sufficient to prevent contamination of nearby waterways. The state currently runs no inspection program for septic systems and regulations are inadequate to prevent leakage.[259] Cleanup plans should fill this regulatory gap and include permits that stop septic tank pollution.

Require measures to clean up local air pollution

Air pollution is a significant source of contamination for several of California's largest waterways such as Lake Tahoe, Santa Monica Bay and San Francisco Bay. To minimize pollution from the air, California's water boards should work with the California Air Resources Board and local air districts to ensure that limits on air pollution protect local waterways as well as public health. The California water boards should also establish the strongest possible restrictions for mercury pollution from refineries.

Cooperation between agencies responsible for reducing water pollution and agencies responsible for reducing air pollution is not unprecedented. In Minnesota, for example, writers of the state mercury cleanup plan outlined the following objectives for airborne mercury reductions:

> *To limit growth of mercury emissions because of construction of new or expanding emission sources in Minnesota, the MPCA will develop a permitting strategy for new and/or expanding air emissions sources of mercury that considers the following:*
>
> - *Establishing an appropriate facility de minimus emissions rate*

- *Requiring new or expanding sources to use state-of-the-art mercury control technology if the de minimus rate is not feasible/ achievable/possible*"[260]

Recommendation Three: Clean Up Existing Pollution

A toxic legacy of mercury, PCB and dioxin pollutes many of California's largest bays, rivers and lakes. The build up of mercury pollution in fish tissues has resulted in fish consumption advisories for waterways such as Clear Lake and San Francisco Bay. PCB and dioxin pollution in Humboldt Bay threaten local wildlife and community health. To clean up this toxic legacy, cleanup plans should:

Pursue polluters responsible for legacy PCB pollution for cleanup costs

To fund the cleanup of PCB contamination, water boards should pursue parties responsible for large amounts of historic PCB emissions into the bay, as U.S. EPA has with PCB contamination off the Palos Verdes Shelf in Santa Monica Bay.

Establish a comprehensive program to clean up mercury pollution leaked into waterways from abandoned and orphaned mine sites

A legacy of abandoned mines and toxic hot spots plagues the largest rivers and bays of California. Cleanup funds to address contamination from the largest site—the Iron Mountain Mine—have been secured by U.S. EPA.[261] Future funding for the cleanup of one of the largest mercury mines in California history—the Sulphur Bank Mine—remains uncertain. Hundreds of other mines also continue to discharge mercury and other toxic metals into the waterways of the state. In addition, several 'hot spots' of mercury, PCB's and other toxic chemicals persist on the bottom of the state's most important bays and lakes.

In order to ensure the full cleanup of this contamination, California should establish a polluter-funded cleanup program, modeled after the successful federal Superfund program. Now bankrupted by the current Administration, the federal program has successfully cleaned up toxic sites around the country. In 1984, Californians passed the Hazardous Substances Cleanup Bond Act, to provide $100,000,000 in bond money to clean up abandoned sites. Officials were charged with replenishing expended funds through efforts to recover cleanup costs from responsible parties. While the program has successfully addressed several contamination sites, this state program is now also bankrupt. Cost recovery from responsible polluters has not been sufficient to keep the fund solvent.

In order to replenish the state fund and resuscitate the program that Californians created two decades ago, the state should establish a renewed California Superfund program modeled after the federal program of the same name. This fund should be supported through fees on industries that are traditionally responsible for toxic contamination sites in the state, such as the mining, petroleum and chemical industries.

Implement an aggressive risk reduction program to limit exposure to toxic contamination while cleanup occurs

While more stringent pollution prevention and cleanup actions may speed up the projected timeline, full cleanup of mercury pollution in waterways such as the Sacramento and San Joaquin rivers and San Francisco Bay will take decades to accomplish. As part of cleanup plans for mercury, the regional water boards should educate impacted communities, including those

with large populations of subsistence or cultural anglers, about health issues related to eating highly contaminated fish and help these communities implement strategies that will lead to real exposure reductions and mitigate health impacts.

Recommendation Four: Ensure Sufficient Flows

Experts often refer to California's water delivery system as one of the most engineered in the world. In a constant battle against Mother Nature, California's rivers have been dammed, diverted and developed to fundamentally alter where and to whom their waters flow. This engineering has devastated the waterways of the entire state. As described in this report, three of the largest polluted rivers in California—the Sacramento, San Joaquin and Klamath—are greatly endangered as a result of dams and diversions. The salmon-filled rivers of the San Joaquin are a thing of the past and the Klamath is quickly heading down the same path.

To protect water quality and fish populations from the impacts of dams and diversions on our largest rivers, cleanup plans should require that water boards:

Withdraw water rights permits issued to any dam operator that does not maintain the downstream health of the waterway

The California Water Code provides the State Water Board with the authority to issue water 'rights' to divert water from the state's waterways. In 1983, the California Supreme Court asserted that this authority also allows the Board to re-allocate existing water rights in order to protect a waterway for the public.[262] The Board applied this authority in 1994 to shield Mono Lake from destructive water withdrawals by the City of Los Angeles. As part of cleanup plans, the State Water Board should again use this authority to withdraw water rights that allow the expansion of dams and increase diversions that will further degrade water quality.

The cleanup plan to restore adequate levels of oxygen in the San Joaquin River took a step toward integrating consideration of water flow in a cleanup plan in asking the state water board to "consider amending current water rights permits for activities that reduce flow... to require that their impacts on excess oxygen demand be evaluated and reduced in coordination with those responsible for other contributing factors." The state water board should pursue this recommendation and require increased flows to raise levels of oxygen in the river.

Require dams maintain water quality necessary to sustain downstream fisheries

In a 2004 federal court ruling, the requirement for federal dam operators to comply with California state law that requires downstream fisheries to be maintained in good condition was clarified. According to the ruling, operators of dams in California must comply with state law that requires protection of downstream fisheries.[263] The State Water Board should work with the California Department of Fish and Game to ensure that this ruling is applied to the operation of dams throughout the state.

Deny state certification for any non-federal dam that degrades water quality

Section 401 of the Clean Water Act provides state governments with the authority to deny certification for the re-licensing of a dam if its continued operation will harm the "beneficial" uses of a waterway.[264] In California, this authority is delegated to the State Water Board, which can deny the '401 certification' to re-license a non-federal

dam. In the next decade, hundreds of non-federal dams on California waterways such as the San Joaquin and Klamath rivers will come up for re-licensing.[265] While not traditionally seen as the purview of TMDL cleanup plans, the State Water Board can take significant steps toward restoring waterways to health by drafting cleanup plans that deny '401 certification' for dams that will further degrade water quality in a river.

Recommendation Five: Restore Habitat

Wetlands and forests lining California's waterways are essential to sustain healthy waterways. Wetlands filter out many pollutants before they reach a waterway and forests can keep a waterway cool enough to support salmon and other aquatic organisms that cannot survive in higher temperatures. Despite their importance, California's wetlands and river-side forests have been largely decimated. Many local initiatives to restore habitat along the bays, rivers and lakes profiled in this report are underway. Cleanup plans should encourage funding for these local habitat restoration projects, wherever possible.

Although there are many factors that impact their effectiveness, vegetative buffers of adequate width can reduce sediment flow into waterways by up to 90 percent and trap up to 90 percent of nutrients.[266] Buffers are vegetated areas located between waterways and land that is disturbed in some way by humans, such as cropland, roadways or development. They may be natural grasses, forested land, or other groundcover, and vary in width based on factors like slope and soil type. Wherever possible, cleanup plans for the largest polluted waterways in the state should also require the establishment of vegetative buffers around waterways to prevent further pollution from reaching them.

Conclusion

California's waterways are at a crossroads. On our current path lies a future filled with many great bays too polluted to swim in much of the year, signature rivers emptied of salmon, and vital drinking water sources polluted by pesticides.

This future, however, is not inevitable.

The Clean Water Act TMDL program provides an historic opportunity to put California on the path to a clean water future. The key to changing our course is to include strong measures in legally-required cleanup plans that will restore these waterways to health.

State and federal law require the State Water Board and regional water boards to formulate plans that will clean up our biggest polluted bays, rivers and lakes. If properly drafted, these plans could bring about a clean water future for California. A series of common-sense, simple actions – from adopting numeric pollution reduction levels in all permits to establishing a polluter-pays cleanup fund to increasing water releases from dams – will restore treasured places like the San Francisco Bay and essential lifelines like the San Joaquin River to health.

Some cleanup plans and restoration measures adopted in California offer a glimpse of the potential: With similar strong plans adopted in the next few years, Californians may one day be able to surf in the waters of Santa Monica Bay without fear of catching an infection; salmon may one day rush unimpeded through the Klamath and San Joaquin Rivers and the Elam Colon will be able to once again resume their traditional way of life.

The Tuolumne River, a tributary to the San Joaquin River, flows through Yosemite National Park (© iStockphoto International)

Endnotes

1. California Department of Water Resources, "State Water Project-Delta," downloaded from http://www.publicaffairs.water.ca.gov/swp/delta.cfm, November 19 2005

2. Robert Steneck et al, "Kelp Forest Ecosystems: Biodiversity, Stability, Resilience and Future, Environmental Conservation," V 29, pp 436-459; Seaweeds: Productivity and Strategies for Growth, K.H. Mann, Science V 182, 975-981

3. Tahoe-Baikal Institute, "Lake Tahoe and Lake Baikal Watersheds," available at http://www.tahoebaikal.org/lakeinfo/, downloaded December 27 2005; Juliane Poirier Lock, California Academy of Sciences, "Forgotten Lake," California Wild, Spring 2004, downloaded from http://www.calacademy.org/calwild/2004spring/stories/clearlake.html, November 5 2005;

4. California Department of Water Resources," California Water Plan: Update 2005, Public Review Draft," downloaded from http://www.waterplan.water.ca.gov/cwpu2005/index.cfm, December 22 2005

5. City of Santa Monica, "Marine Education Programs," downloaded from http://santamonica.org/epd/residents/Education/marine.htm, November 25 2005; Eric Woolsen, Stormwater: The Journal for Surface Water Quality Professionals, "Passing Proposition O", March/April 2005, downloaded from http://www.stormh2o.com/sw_0503_proposition.html, November 24 2005,

6. American Sportfishing Association, "Economic Impact of Sportfishing, 2003 State Overview," available at http://www.asafishing.org/asa/statistics/economic_impact/index.html, downloaded January 3 2006

7. U.S. Geological Survey, "Understanding the Urban Influences on Santa Monica Bay, CA" downloaded from http://walrus.wr.usgs.gov/socal/smbay/, December 15 2005

8. Dennis D. Murphy and Christopher M. Knopp, editors, "The Lake Tahoe Watershed Assessment, Volume 1, General Technical Report," PSW-GTR-175, Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture available at http://www.fs.fed.us/psw/publications/documents/gtr-175

9. U.S. Department of the Interior, National Park Services, "National Register of Historic Places Continuation Sheet," Section number 7, Page 2, downloaded from http://www.tccn.net/sloarchaeology/rattlesnakeNR2.pdf; Central Valley Regional Water Quality Control Board, "Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for the Control of Mercury in Clear Lake (Lake County), Staff Report and Functionally Equivalent Document," Final Report December 2002

10. Deltakeeper Chapter of Baykeeper et al., "Review of the Irrigated Lands Waiver," (presentation), June 2005

11. Federal Water Pollution Control Act, 33 U.S.C. 1251 et seq., Section 101(b)(2)

12. Federal Water Pollution Control Act, 33 U.S.C. 1251 et seq., Sec 101(a)(1), Sec 101(a)(2)

13. 'Water quality standards' are defined by the California State Water Resources Control Board as made up of four parts – the designated uses of the waterway, water quality objectives to ensure those uses, programs designed to meet the objectives and protections against degradation for waterways that already meet those objectives; Central Coast Regional Water Quality Control Board, "Definitions," downloaded from http://www.waterboards.ca.gov/centralcoast/TMDL/Definitions.htm, November 20 2005

14. U.S. Environmental Protection Agency, "Guidance for Water Quality-Based Decisions: The TMDL Process, Chapter 3-Development and Implementation of a TMDL," downloaded from http://www.epa.gov/OWOW/tmdl/decisions/dec3.html, January 9 2005

15. Robert Perciasepe, "New Policies for Establishing and Implementing Total Maximum Daily Loads (TMDLs)," (memorandum to Regional Administrators Regional Water Division Directors), August 8, 1997, downloaded from http://www.epa.gov/OWOW/tmdl/ratepace.html, January 8, 2006

16. A "Water Quality Control Plan" or "Basin Plan" consists of a designation or establishment for the waters within a specified area of all of the following: (1) Beneficial uses to be protected, (2) Water quality objectives and (3) A program of implementation needed for achieving water quality objectives" California Water Code §13050(j)

17. California Water Code § 13242

18. Clean Water Act, § 303(e)

19. California Water Code, §§13140, 13146

20. State Water Resources Control Board, "Draft State of California SB 469 TMDL Guidance, A Process for Addressing Impaired Waters in California," March 2005, downloaded from http://www.waterboards.ca.gov/agendas/2005/june/0616-13att2.pdf, January 14 2006

21. State Water Resources Control Board, "Policy for the Implementation and Enforcement of the Nonpoint Source Pollution Control Program," (Fact Sheet)

22. State Water Resources Control Board, "Draft State of California SB 469 TMDL Guidance, A Process for Addressing Impaired Waters in California," March 2005, downloaded from http://www.waterboards.ca.gov/agendas/2005/june/0616-13att2.pdf, January 14 2006

23. National Oceanic and Atmospheric Administration," San Francisco Bay Watershed Database and Mapping Project, San Francisco Bay Environment," downloaded from http://response.restoration.noaa.gov/legacy/watersheds/sanfrancisco/sfb_html/sfbenv.html, November 15 2005

24. U.S. Environmental Protection Agency, "Survey for National Volunteer Monitoring Directory," downloaded from http://yosemite.epa.gov/water/volmon.nsf/0/abfb0780c8230ec98525671d006c4576?OpenDocument, November 13 2005; U.S. Fish and Wildlife Service – Pacific Region, "Don Edwards San Francisco Bay National Wildlife Refuge," downloaded from www.fws.gov/destbay, January 8 2006

25. Institute for Fisheries Resources, "San Francisco Bay Restoration Program," downloaded from http://www.ifrfish.org/programs/restoration.html, November 19 2005

26. U.S. Geological Survey, "San Francisco Bay Program: Lessons Learned for Managing Coastal Water Resources," downloaded from http://water.usgs.gov/wid/html/sfb.html, November 19 2005

27. Kathleen M. Wong, "Return of the Native Oyster," California Wild: The Magazine of he California Academy of Sciences, downloaded from fall/stories/horizons.html" http://www.calacademy.org/calwild/2004 fall/stories/horizons.html, November 19 2005

28. The Bay Institute, "The Bay Institute Ecological Scorecard, 2005 San Francisco Bay Index," downloaded from www.bay.org/scorecard/2005.Bay.Index.Ecpanded.Report.pdf, downloaded 25 November 2005

29. Natural Resources Defense Council, "Testing the Waters 2005," (2005), downloaded from http://www.nrdc.org/water/oceans/ttw/sumcal.pdf, January 10 2005

30. United States Geological Survey, "San Francisco Bay Program: Lessons Learned for Managing Coastal Water Resources," downloaded from http://water.usgs.gov/wid/html/sfb.html, November 22 2005; San Francisco Bay Regional Water Quality Control Board, "San Francisco Bay Mercury TMDL, Appendix C: Staff Report," September 15, 2004, downloaded from http://www.waterboards.ca.gov/sanfranciscobay/sfbaymercurytmdl.htm, November 5 2005

31. Glen Martin, "Our Poisoned Bay: Despite direct end to piping of sewage, pollution worse now than 30 years ago," Monday August 2 1999,

downloaded from http://www.sfgate.com/cgi-bin/article.cgi?f=/chronicle/archive/1999/08/02/MN14115.DTL&type=printable, January 12 2006

32. Kathryn M. Kuivila et al., "Diazinon Concentrations and Transport in the Sacramento River and San Francisco Bay," California, February 1993, U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings of the Technical Meeting, Colorado Springs, Colorado, September 20-24, 1993, Water-Resources Investigations Report 94-4015

33. Bill Johnson, San Francisco Bay Regional Water Quality Control Board, "Diazinon and Pesticide-Related Toxicity in Bay Area Urban Creeks, Proposed Basin Plan Amendment and Staff Report," November 9 2005, downloaded from http://www.waterboards.ca.gov/sanfranciscobay/TMDL/urbcrksdiazinon/b_final_staff_report.pdf, January 9 2006

34. D. P. Weston *et al*., "Distribution and Toxicity of Sediment-Associated Pesticides in Agriculture-Dominated Water Bodies of California's Central Valley," Environmental Science and Technology, 2004, 38, 2752-2759

35. U.S. Geological Survey, "San Francisco Bay Program: Lessons Learned for Managing Coastal Water Resources," downloaded from http://water.usgs.gov/wid/html/sfb.html, November 19 2005

36. Pam Tsai, Rainer Hoenicke, "San Francisco Bay Atmospheric Pilot Study Part 1: Mercury," San Francisco Estuary Institute, July 2001, p 8

37. Richard Looker & Bill Johnson, San Francisco Bay Regional Water Quality Control Board, "Mercury in San Francisco Bay, Total Maximum Daily Load (TMDL) Proposed Basin Plan Amendment and Staff Report," September 2, 2004

38. Jane Kay, "State Sued Over Bay Dioxin," San Francisco Chronicle, March 14, 2001

39. California Department of Fish & Game, "New Almaden Mine CERCLA Site," downloaded from http://www.dfg.ca.gov/Ospr/organizational/scientific/nrda/NRDAalmaden.htm, December 27 2005

40. California Environmental Protection Agency: Office of Environmental Health Hazard Assessment, "Fish-Mercury in Fish, Methylmercury in Fish: Information for Fish Consumers," downloaded from http://www.oehha.ca.gov/fish/hg/index.html, November 26 2005

41. San Francisco Estuary Institute, "San Francisco Estuary Baylands Ecosystem Goals Draft Report for Public Review," Chapter 6, June 26, 1998, downloaded from http://www.sfei.org/sfbaygoals/docs/goals1998/draft062698/html/chap06.html, November 29 2005

42. Nicole Diroff & Amy Thomas, "Options for Dental Mercury Reduction Programs: Information for State, Provincial and Local Governments: A Report of the Binational Toxics Strategy Mercury Work Group Co-Chairs," revised August 4 2004, downloaded from http://www.epa.gov/region5/air/mercury/dentaloptions3.pdf, January 9, 2006

43. State Water Board Resolution No. 2005-0060, downloaded from http://www.waterboards.ca.gov/resdec/resltn/2005/rs2005-0060.pdf, January 9, 2006

44. State Water Resources Control Board and California Coastal Commission, "Plan for California's Nonpoint Source Pollution Control Program (Program Plan),"(2000)

45. Legislative Analyst's Office, "Improvements Needed in Clean Water Enforcement," February 16, 1999, downloaded from http://www.lao.ca.gov/analysis_1999/resources/resources_depts3_anl99.html#_1_6, January 9 2006

46. Heal the Bay, "San Francisco Bay," 15th Annual Beach Report Card," downloaded from http://www.healthebay.org/brc/annual/2005/counties/sf/analysis.asp, November 13 2005

47. Wyatt Buchanan, "San Francisco: 17-cent fee on bags OK'd by environmental panel," San Francisco Chronicle, January 26 2005, downloaded from http://sfgate.com/cgi-bin/article.cgi?f=/chronicle/archive/2005/01/26/BAGS.TMP, November 20 2005

48. The Brake Pad Partnership, "Charge to Reviewers for Bay Modeling Draft Work Plan," September 22 2005, downloaded from http://www.suscon.org/brakepad/pdfs/ChargeToReviewersForBayModelingDraftWorkPlan09-22.pdf, January 9, 2006

49. Nicole Diroff & Amy Thomas, "Options for Dental Mercury Reduction Programs: Information for State, Provincial and Local Governments: A Report of the Binational Toxics Strategy Mercury Work Group Co-Chairs," revised August 4 2004, downloaded from http://www.epa.gov/region5/air/mercury/dentaloptions3.pdf, January 9, 2006

50. Stormwater Management Inc., "Case Study: San Diego Galvanizing," downloaded from http://www.stormwaterinc.com/ia-cs-san-diego.php , November 21 2005

51. Minnesota Pollution Control Agency, "Minnesota's Total Maximum Daily Load Study of Mercury, Draft," Draft May 24 2005, downloaded from http://www.pca.state.mn.us/publications/wq-iw4-01b.pdf, November 29, 2005

52. San Francisco Bay Regional Water Quality Control Board, "San Francisco Bay Mercury TMDL, Appendix C: Staff Report," September 15, 2004, downloaded from http://www.waterboards.ca.gov/sanfranciscobay/sfbaymercurytmdl.htm, November 5 2005

53. Humboldt Baykeeper, "Fisheries Resources," downloaded from http://www.humboldtbaykeeper.org/humboldtbayp3.htm, January 16 2006

54. The Environmental Protection Information Center, "The Ecology of Humboldt Bay," downloaded from http://www.wildcalifornia.org/publications/article-37, December 28 2005

55. *ibid.*

56. California State Water Resources Control Board, "Final 2002 Clean Water Act Section 303(d) List of Water Quality Limited Segments," downloaded from http://www.waterboards.ca.gov/tmdl/303d_lists.html, November 20 2005; The Environmental Protection Information Center, "Forgotten But Not Gone: Dioxin Pollution Threatens Humboldt Bay," downloaded from http://www.wildcalifornia.org/publications/article-17, December 29 2005;

57. Humboldt Baykeeper, "Toxics," downloaded from http://www.humboldtbaykeeper.org/bayissuesp2.htm, December 29 2005

58. Brian Tokar; "Monsanto: A Checkered History," The Ecologist Sep/Oct98, downloaded from http://www.mindfully.org/Industry/Monsanto-Checkered-HistoryOct98.htm, January 9 2005

59. U.S. Environmental Protection Agency, "Polychlorinated Biphenyls and You," downloaded from http://yosemite.epa.gov/R10/OWCM.NSF/0/a9578719c73ad1de882569ed00782e89?OpenDocument, December 29 2005

60. U.S. Environmental Protection Agency, "PCBs; Manufacturing, Processing, Distribution in Commerce and Use Bans; Final Rule," available at http://www.epa.gov/opptintr/pcb/pubs/laws.html, downloaded December 29 2005

61. Earth Tech, "PCBs," downloaded from http://www.shtc.ca/PCBs.htm, January 9 2005

62. Heidi Walters, "Bay dredge spoils may be beach-bound again," North Coast Journal, August 18, 2005, downloaded from http://www.northcoastjournal.com/081805/news0818.html,

63. City of Santa Monica, "Marine Education Programs," downloaded from http://santa-monica.org/epd/residents/Education/marine.htm, November 25 2005

64. Santa Monica Bay Restoration Commission, "The Bay's Sandy Beaches," downloaded from http://www.santamonicabay.org/site/problems/layout/hSandyBeaches.jsp, November 27 2005

65. Robert Steneck et al., "Kelp Forest Ecosystems: Biodiversity, Stability, Resilience and Future, , Environmental Conservation," V 29, pp 436-459; Seaweeds: Productivity and Strategies for Growth, K.H. Mann, Science V 182, 975-981

66. City of Santa Monica, "Marine Education Programs," downloaded from http://santa-monica.org/epd/residents/Education/marine.htm, November 25 2005; Eric Woolsen, "Passing Proposition O," Stormwater: The Journal for Surface Water Quality Professionals, March/April 2005, downloaded from http://www.stormh2o.com/sw_0503_proposition.html, November 24 2005,

67. U.S. Geological Survey, "Understanding the Urban Influences on Santa Monica Bay, CA" downloaded from http://walrus.wr.usgs.gov/socal/smbay/, December 15 2005

68. Heal the Bay, "Heal the Bay Declares Worst Water Quality in Years for Los Angeles County,"(Press Release), October 25 2005, downloaded from http://www.healthebay.org/assets/pdfdocs/pressreleases/2005_10_26_summerbrc.pdf, November 23 2005

69. California State Water Resources Control Board, "Erase the Waste, Stormwater Pollution," downloaded from http://www.swrcb.ca.gov/erasethewaste/swpollution.html , November 22 2005

70. Neal Shapiro, Environmental Programs Division, City of Santa Monica, "Urban Runoff Management: Back to the Past Then into the Future," downloaded from http://www.stormwaterauthority.org/, November 21 2005

71. Santa Monica Bay Restoration Commission, "Habitats-Wetlands and Riparian Corridors," downloaded from http://www.santamonicabay.org/site/problems/layout/hWetlands.jsp, January 18 2006

72. County of Los Angeles Department of Public Works, "Stormwater Pollution Prevention Statistics," downloaded from http://ladpw.org/PRG/StormWater/Page_20.cfm, November 18 2005

73. Santa Monica Bay Restoration Commission, "Pollutants and their Impacts," downloaded from http://www.santamonicabay.org/site/problems/layout/water.jsp, November 22 2005

74. *ibid.*

75. Santa Monica Bay Restoration Project, "Epidemiological Study of Possible Adverse Health Effects of Swimming in Santa Monica Bay,"(1996) downloaded from http://www.santamonicabay.org, January 9 2006

76. Southern California Coastal Watershed Research Project, "Air Pollution Impacts Santa Monica Bay," 2002, downloaded from http://www.esa.org/science/publications/wr-AtmosphericDeposition2000.php, November 28 2005

77. Santa Monica Bay Restoration Commission, "Pollutants and their Impacts," downloaded from ht http://www.santamonicabay.org/site/problems/layout/water.jsp, November 22 2005

78.*ibid.*

79. UCLA School of Law's Frank G. Wells Environmental Clinic, "Improving Water Quality in the Santa Monica Bay and its Tributaries: A Long-term Outlook," downloaded from http://www.law.ucla.edu/docs/brief4.pdf, January 18 2006

80. Heal the Bay, "15th Annual Beach Report Card," (2005) downloaded from http://www.healthebay.org/brc/annual/2005/counties/la/analysis.asp, January 9 2006

81. U.S. Geological Survey, "Tracking Contaminants in Santa Monica Bay, Offshore of Greater Los Angeles," 2002, downloaded from http://pubs.usgs.gov/fs/2002/fs155-02/, November 20 2005

82. Heal the Bay, "15th Annual Beach Report Card," (2005) downloaded from http://www.healthebay.org/brc/annual/2005/counties/la/analysis.asp, January 9 2006

83. Santa Monica Bay Restoration Project, "Improving Septic System Management in the Santa Monica Bay Watershed," January 2001, downloaded from http://www.santamonicabay.org/uploads/project/taskforces/SepticsTaskForceFinal2001.pdf, January 7 2006

84. Santa Monica Bay Restoration Commission, "Habitats-Wetlands and Riparian Corridors," downloaded from http://www.santamonicabay.org/site/problems/layout/hWetlands.jsp, January 18 2006

85. Santa Monica Bay Restoration Commission, "Habitats-Wetlands and Riparian Corridors," downloaded from http://www.santamonicabay.org/site/problems/layout/hWetlands.jsp, January 18 2006

86. Los Angeles Regional Water Quality Control Board, "Trash Total Maximum Daily Loads for the Los Angeles River Watershed," September 19 2001, downloaded from http://www.waterboards.ca.gov/losangeles/html/meetings/tmdl/01_0919_lar_L.%20A.%20River%20Trash%20TMDL.pdf, November 20 2005

87. City of Los Angeles Stormwater Program, "TMDLs," downloaded from http://www.lastormwater.org/WPD/program/TMDLs/bacteria.htm, November 27 2005

88. Kathleen Pender, "Adding up the cost of bags," San Francisco Chronicle, January 25, 2005, downloaded from http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2005/01/25/BUGCJAVPAI1.DTL, November 18 2005

89. Miguel Bustillo and Kenneth R. Weiss, "Bush Plan Could Drain Effort to Clean Up Waters," Los Angeles Times, February 9, 2005; downloaded November 18 2005

90. Unified Port of San Diego, "Shelter Island," downloaded from ttp://www.portofsandiego.org/sandiego_publicart/PDF%20files/resource_guide/tab01_shelter_island.pdf, November 10 2005

91. San Diego Hall of Champions Sports Museum, "New Exhibits, America's Cup Exhibit," downloaded from http://www.sdhoc.com/main/exhibits/new, November 11 2005

92. California Regional Water Quality Control Board, San Diego Region, "Total Maximum Daily Load for Dissolved Copper In Shelter Island Yacht Basin, San Diego Bay," February 9 2005, downloaded from http://www.waterboards.ca.gov/sandiego/tmdls/tmdl_files/shelter%20island/final%20docs/SIYB%20Tech%20Rept%20Final%202-05.pdf, November 11 2005

93. *ibid.*

94. California Regional Water Quality Control Board, San Diego Region, "Total Maximum Daily Load for Dissolved Copper In Shelter Island Yacht Basin, San Diego Bay," February 9

2005, downloaded from http://www.waterboards.ca.gov/sandiego/tmdls/tmdl_files/shelter%20island/final%20docs/SIYB%20Tech%20Rept%20Final%202-05.pdf, November 11 2005

95. *ibid.*

96. *ibid.*

97. Encyclopedia Britannica Online, "Sacramento River," downloaded from http://www.britannica.com/eb/article-9064665, November 26 2005

98. Sacramento River Advisory Council, SB 1086 "Sacramento River Conservation Area Forum Handbook," September 2003, downloaded from http://www.sacramentoriver.ca.gov/publications/handbook/handbook.html, January 8 2006

99. United States Department of the Interior, "State and Federal Officials Announce Plan to Improve Water Supply and Water Quality and Restore Delta Habitat," (Press Release) June 9, 2000, downloaded from http://www.doi.gov/news/archives/000609.html , November 25 2005

100. United States Bureau of Reclamation, "Central Valley Project General Overview," downloaded from http://www.usbr.gov/dataweb/html/cvp.html, November 5 2005

101. Katibah, E.D. 1984. "A brief history of riparian forests in the Central Valley of California," pp. 23-29. IN California Riparian Systems: Ecology, Conservation, and Production Management. R.E. Warner and K.M. Hendrix (eds.). University of California Press. Berkeley, CA.

102. The term 'abandoned' mine commonly refers to an inactive mine for which there no longer exists an identifiable owner or party for cleanup.

103. Joseph Domagalski and Larry R. Brown, United States Geological Survey, "National Water Quality Assessment Program: The Sacramento River Basin, NAWQA Fact Sheet 94-029," available at http://ca.water.usgs.gov/archive/reports/fs94029/, downloaded December 2 2005

104. Mike Taugher, "Environmental sirens in Delta are screaming," Contra Costa Times, Sun, May. 01, 2005

105. California Department of Fish and Game, Central Valley-Delta Branch, "Midwater Trawl: Delta Smelt Abundance Indices," available at http://www.delta.dfg.ca.gov/data/mwt/charts.asp, downloaded January 9 2006

106. Joseph Domagalski and Larry R. Brown, United States Geological Survey, "National Water Quality Assessment Program: The Sacramento River Basin, NAWQA Fact Sheet 94-029," available at http://ca.water.usgs.gov/archive/reports/fs94029/, downloaded December 2 2005

107. Stuart Leavenworth, "Pollution worries may alter course of Colusa Drain," Sacramento Bee, Aug 22, 2004

108. Central Valley Regional Water Quality Control Board, "September 2004 Total Maximum Daily Load (TMDL) Report for the Pesticides Diazinon & Chlorpyrifos In: Arcade Creek, Elder Creek, Elk Grove Creek, Morrison Creek, Chicken Ranch Slough, and Strong Ranch Slough, Sacramento County, California," downloaded from http://www.waterboards.ca.gov/centralvalley/programs/tmdl/urbancreeks/index.html, November 29 2005; D. P. Weston *et al*., "Distribution and Toxicity of Sediment-Associated Pesticides in Agriculture-Dominated Water Bodies of California's Central Valley," Environmental Science and Technology, 2004, 38, 2752-2759

109 U.S. Environmental Protection Agency, "EPA Announces Elimination of all Indoor Uses of Widely-Used Pesticide Diazinon; Begins Phase-Out of Lawn and Garden Uses," (Press Release), December 5, 2000, downloaded from http://yosemite.epa.gov/opa/admpress.nsf/0/c8cdc9ea7d5ff585852569ac0077bd31?OpenDocument, November 29 2005

110. D. P. Weston *et al*., "Distribution and Toxicity of Sediment-Associated Pesticides in Agriculture-Dominated Water Bodies of California's Central Valley," Environmental Science and Technology, 2004, 38, 2752-2759

111. Mike Taugher, "Environmental sirens in Delta are screaming," Contra Costa Times, Sun, May. 01, 2005

112. California Regional Water Quality Control Board, Central Valley Region, Resolution No R5-2005-0137, available at http://www.waterboards.ca.gov/centralvalley/adopted_orders/Waivers/R5-2005-0137.pdf, downloaded December 6 2005

113. Deltakeeper Chapter of Baykeeper et al., "Review of the Irrigated Lands Waiver," (presentation), June 2005

114. Central Valley Regional Water Quality Control Board, "September 2004 Total Maximum Daily Load (TMDL) Report for the Pesticides Diazinon & Chlorpyrifos In: Arcade

Creek, Elder Creek, Elk Grove Creek, Morrison Creek, Chicken Ranch Slough, and Strong Ranch Slough, Sacramento County, California," downloaded from http://www.waterboards.ca.gov/centralvalley/programs/tmdl/urbancreeks/index.html, November 29 2005;

115. D.P. Weston et al.," Aquatic Toxicity Due to Residential Use of Pyrethroid Insecticides," (2005) Environmental Science and Technology

116. County of Sacramento, "Sacramento County Stormwater Quality Program," downloaded from http://www.msa.saccounty.net/sactostormwater/whoweare.asp, November 25 2005

117. California Environmental Protection Agency, Department of Toxic Substances Control, "Fact Sheet: Abandoned Mine Lands Preliminary Assessment Handbook," Revised June 2001, downloaded from http://www.dtsc.ca.gov/SiteCleanup/upload/FS_SMP_MINE.pdf, January 9 2006

118. U.S. Environmental Protection Agency, "Mercury: Health Effects," available at http://www.epa.gov/mercury/effects.htm#meth, downloaded January 9 2006

119. International Indian Treaty Council, "Mercury Contamination and Community Health in Northern California," 1999, downloaded from http://www.treatycouncil.org/MercuryReportLoRez1.pdf, November 27 2005

120. International Indian Treaty Council, "Mercury Contamination and Community Health in Northern California," 1999, downloaded from "http://www.treatycouncil.org/MercuryReportLoRez1.pdf" http://www.treatycouncil.org/MercuryReportLoRez1.pdf, November 27 2005

121. Environment Canada, "Mercury and the Environment: Biogeochemistry," available at http://www.ec.gc.ca/MERCURY/EH/EN/ehb.cfm?SELECT=EH, downloaded January 7 2006

122. California Environmental Protection Agency: Office of Environmental Health Hazard Assessment, "Fish-Mercury in Fish, Methylmercury in Fish: Information for Fish Consumers," Downloaded from http://www.oehha.ca.gov/fish/hg/index.html, November 26 2005

123. U.S. Environmental Protection Agency, "U.S., State, Announce Long-Term Settlement for Iron Mountain Mine," (Press Release), October 19, 2000, available at http://yosemite.epa.gov/opa/admpress.nsf/0/6d8c6077be9d48d68525697d005f3ad3?OpenDocument, Downloaded January 7 2006

124. Emgold Mining Company, "Emgold Prepares to Go Underground at the Idaho-Maryland Gold Mine," (press release) December 14 2004, downloaded from http://www.emgold.com/s/News-2004.asp?ReportID=95185&_Type=News-Releases-2004&_Title=Emgold-Prepares-to-Go-Underground-at-the-Idaho-Marylnd-Gold-Mine, November 25 2005

125. Doug Mattson, "Special Report: Golden Gamble in Grass Valley," Yubanet.com, Mar 7, 2005, downloaded from http://yubanet.com/artman/publish/article_18785.shtml, November 26 2005

126. U.S. Bureau of Reclamation, "Central Valley Project General Overview," http.://www.usbr.gov/dataweb/html/cvp.html#general, downloaded December 26 2005

127. USA Fishing, "Valley Ag Moves to Destroy the Central Valley Project Improvement Act," Fishing 4 News, December 10 2005, downloaded from http://usafishing.com/news.html, January 7 2006

128. LEAVE TWO LINES FOR CITATION

129. Mike Taugher, "Environmental sirens in Delta are screaming," Contra Costa Times, Sun, May. 01, 2005

129. California Department of Fish and Game, Central Valley-Delta Branch, "Midwater Trawl: Delta Smelt Abundance Indices," available at http://www.delta.dfg.ca.gov/data/mwt/charts.asp, downloaded January 9 2006

130. Friends of the River, "Auburn Dam Rising from the Dead?" downloaded from http://www.friendsoftheriver.org/Articles/2005_AuburnDamRising.html, November 26 2005; Lori Pottinger, California Flood Control System Springs Leaks, World Rivers Review, Volume 12 Number 1/February 1997

131. Greg Lucas, "Katrina levee breach dredges up canal debate: Peripheral project rejected in 1982 — new proposals met with tepid response," San Francisco Chronicle, November 14 2005, U.S. Bureau of Reclamation, Central Valley Project Delta Division, downloaded from http://www.usbr.gov/dataweb/html/delta.html, November 15 2005

132. Glen Martin, "Tribe sees dam plan as cultural genocide: Raising lake level would drown sites sacred to the Winnemem Wintu," San Francisco Chronicle, February 27 2005

133. Katibah, E.D. 1984. "A brief history of riparian forests in the Central Valley of California," pp. 23-29. IN California Riparian Systems: Ecology, Conservation, and Production Management. R.E. Warner and K.M. Hendrix (eds.). University of California Press. Berkeley, CA

134. Sacramento River Advisory Council, "SB 1086 Sacramento River Conservation Area Forum Handbook," September 2003, downloaded from http://www.sacramentoriver.ca.gov/publications/handbook/handbook.html, January 8 2006

135. California Environmental Protection Agency, "The History of the California Environmental Protection Agency: Department of Toxic Substances Control," downloaded from http://www.calepa.ca.gov/About/History01/, January 7 2006

136. National Audubon Society v. Superior Court, 33 Cal.3d 419, 446-447 (1983), cert. denied 454 U.S. 977 (1983).

137. Natural Resources Defense Council, et al. v. Kirk Rodgers et al. Case No. CIV-S-88-1658 (U.S. District Court for the Eastern District of California).

138. Sacramento River Advisory Council, "SB 1086 Sacramento River Conservation Area Forum Handbook," September 2003, downloaded from http://www.sacramentoriver.ca.gov/publications/handbook/handbook.html, January 8 2006

139. Katibah, E.D. 1984. A brief history of riparian forests in the Central Valley of California, pp. 23-29. IN California Riparian Systems: Ecology, Conservation, and Production Management. R.E. Warner and K.M. Hendrix (eds.). University of California Press. Berkeley, CA

140. U.S. Fish and Wildlife Service, "Lower 48's largest bald eagle colony is wintering in the Klamath Basin," North Texas e-news, December 28 2005, downloaded from http://www.ntxe-news.com/artman/publish/article_30893.shtml, January 2 2006

141. PRBO Conservation Science, "Waterbirds of the Klamath Basin," downloaded from http://www.prbo.org/cms/index.php?mid=286&module=browse, November 26 2005

142. Coalition for the Klamath Basin, "A Conservation Vision for the Klamath Basin," March 2000, downloaded from http://www.wilderness.org/Library/Documents/upload/Klamath-Vision.pdf, November 15 2005: p 2

143. Board on Environmental Studies and Toxicology, National Academy of Science, "Endangered and Threatened Fishes in the Klamath River Basin: Causes of Decline and Strategies for Recovery," 2004, found at http://www.nap.edu/books/0309090970/html, January 2 2006

144. Klamath Inter-Tribal Fish & Water Commission, "Dammed to Extinction," downloaded from http://www.pelicannetwork.net/krc.htm, November 15 2005

145. Northern California – North Coast Region, Department of Fish and Game, The Resources Agency, State of California, "September 2002 Klamath River Fish Kill: Preliminary Analysis of Contributing Factors," January 2003, downloaded from http://www.pcffa.org/KlamFishKillFactorsDFGReport.pdf, January 2 2006

146. United States Geological Survey, Oregon District Hydrologic Studies, PN381 "Assessment of Nutrient Loading to Upper Klamath Lake, Oregon," downloaded from http://or.water.usgs.gov/projs_dir/pn381/pn381.html, November 18 2005

147. State of Oregon Department of Environmental Quality, "Upper Klamath Lake Drainage Total Maximum Daily Load, and Water Quality Management Plan (WQMP)", May 2002, p 42 available at http://www.deq.state.or.us/WQ/TMDLs/KlamathBasin/UKLDrainage/UprKlamathTMDL.pdf , downloaded December 24 2006

148. Conservation Biology Institute, "Preliminary Aquatic Integrity Assessment for the Lower/Middle Klamath River and the Upper Sacramento River," available at http://www.consbio.org/cbi/applied_research/klamath_sacramento_aquatic/klamath_sacramento_aquatic.htm, downloaded December 15 2006

149. Environmental Law Foundation, Western Mining Action Project, "Complaint for Declaratory and Injunctive Relief, Karuk Tribe of California vs. United States Forest Service *et al*;" contact Karuk Tribe of California for document

150. Environmental Law Foundation, Western Mining Action Project, "Complaint for Declaratory and Injunctive Relief, Karuk Tribe of California vs. United States Forest Service *et al*.," contact Karuk Tribe of California for document

151 Northern California – North Coast Region, Department of Fish and Game, The Res.ources

Agency, State of California, "September 2002 Klamath River Fish Kill: Preliminary Analysis of Contributing Factors," January 2003, downloaded from http://www.pcffa.org/KlamFishKillFactorsDFGReport.pdf, January 2 2006 p 54

152. Pacific Coast Federation of Fishermen's Association, "Court Ruling Against Klamath Irrigators Gives Lower River Salmon Fishermen A Chance for Survival," (Press Release), April 30 2001, downloaded from http://www.pcffa.org/pr01-1nw.htm, January 2 2006

153. World Health Organization, "Toxic Cyanobacteria in Water: a guide to their public health consequences, monitoring and management," edited by J. Bartram & I. Chorus. Geneva (1999)

154. Curtis Cude, Oregon Department of Environmental Quality, "Oregon Water Quality Index Report for Klamath Basin," http://www.deq.state.or.us/lab/wqm/wqi/klamath/klamath3.htm, downloaded December 26 2005

155. United States Geological Survey, Oregon District Hydrologic Studies, PN381 "Assessment of Nutrient Loading to Upper Klamath Lake, Oregon," downloaded from http://or.water.usgs.gov/projs_dir/pn381/pn381.html, November 18 2005

156. State of Oregon Department of Environmental Quality, "Upper Klamath Lake Drainage Total Maximum Daily Load, and Water Quality Management Plan (WQMP)," May 2002, p 42 available at http://www.deq.state.or.us/WQ/TMDLs/KlamathBasin/UKLDrainage/UprKlamathTMDL.pdf , downloaded December 24 2006

157. Kevin Kennedy & Jim Woodward, Systems Assessment and Facilities Siting Division, California Energy Commission, "Preliminary Assessment of Energy Issues Associated with the Klamath Hydroelectric Project," May 2003, p 1, available at http://www.energy.ca.gov/reports/2003-07-15_700-03-007.PDF, downloaded January 2 006

158. Dan Bacher, "Tribes & fishermen take Klamath River fight to Scottish Power," Dissident Voice, July 3 2004, downloaded from http://www.eurocbc.org/scottishpower_pacificorp_fishing_damage_03jul2004page1709.html, January 2 2006

159. Code of Federal Regulations, Title 33 – Navigation and Navigable Waters Chapter 26 – Water Pollution Prevent and Control Subchapter IV – Permits and Licenses, Sec. 1341. Certification

160. KRBFTF (Klamath River Basin Fisheries Task Force). "Long range plan for the Klamath River basin conservation area fishery restoration program," (1991) available from the U.S. Fish and Wildlife Service, Yreka Fish and Wildlife Office, Yreka, CA. 96097.

161. California Regional Water Quality Control Board, "Total Maximum Daily Load for Salinity and Boron in the Lower San Joaquin River," January 2002, p 1, downloaded from http://www.waterboards.ca.gov/centralvalley, January 9 2006

162. United States Geological Survey, California Water Science Center, "DOC Loads-Tidal Wetlands (52844)," downloaded from http://ca.water.usgs.gov/cgi-bin/influx/projectsapp.pl?preview=26, November 22 2005; California Department of Water Resources, Public Affairs, "State Water Project – Delta, Where Rivers Meet," The Sacramento-San Joaquin Delta, downloaded from http://www.publicaffairs.water.ca.gov/swp/delta.cfm, November 25 2005

163. U.S. Fish and Wildlife Service, "A Framework for Collaborative Action on Wetlands," Chapter 1, p 1, California Department of Water Resources, Public Affairs," State Water Project – Delta, Where Rivers Meet…The Sacramento-San Joaquin Delta," downloaded from http://www.publicaffairs.water.ca.gov/swp/delta.cfm, November 25 2005

164. California Department of Water Resources, "State Water Project: Delta," downloaded from http://www.publicaffairs.water.ca.gov/swp/delta.cfm, November 26 2005

165. The Bay Institute, "From the Sierra to the Sea: A San Francisco Bay/Delta Primer," downloaded from http://www.bay.org/about_the_bay.htm, November 26 2005

166. Moore, S., et al., "Fish and wildlife resources and agricultural drainage in the San Joaquin Valley, California," Volume 1.(1990) San Joaquin Valley Drainage Program, Sacramento, California. pp. 364

167. University of California, Santa Cruz, "Inoperative Mercury Mines in the Coast Ranges Fingered as a Major Source of Mercury Contamination in California Waters," (Press Release), November 8 2000, downloaded from http://www.ucsc.edu/news_events/press_releases/archive/00-01/11-00/mines.html, January 7 2006

168. Department of Pesticide Regulation "2003 Annual Pesticide Use Report: Fresno County Indexed by Commodity. Sacramento," California

Environmental Protection Agency., downloaded from http://www.dpr.ca.gov, January 10 2006

169. Deltakeeper Chapter of Baykeeper et al., "Review of the Irrigated Lands Waiver," (presentation), June 2005, contact California Sportfishing Protection Alliance

170. G. Fred Lee, "Evaluating Nitrogen and Phosphorus Control in Nutrient TMDLs," Stormwater, downloaded from http://www.forester.net/sw_0201_evaluating.html, January 7 2006

171. California Regional Water Quality Control Board, Central Valley Region, Resolution No R5-2005-0137, available at http://www.waterboards.ca.gov/centralvalley/adopted_orders/Waivers/R5-2005-0137.pdf, downloaded December 6 2005

172. UC Santa Cruz, "Inoperative Mines in the Coast Ranges Fingered as a Major Source of Mercury Contamination in California Waters," (press release), November 8, 2000, downloaded from http://www.ucsc.edu/news_events/press_releases/archive/00-01/11-00/mines.html, November 28 2005

173. U.S. Environmental Protection Agency, "Mercury: Health Effects," available at http://www.epa.gov/mercury/effects.htm#meth, downloaded January 9 2006

174. United States Bureau of Reclamation, "Dams, Projects & Powerplants, CVP-Friant Division, California," downloaded from http://www.usbr.gov/dataweb/html/friant.html#general, November 26 2005

175. Grossi, Mark; Cross, Mark, "Rescuing the San Joaquin," The Fresno Bee, 1999; 14 p. G438 N9-1

176. Natural Resources Defense Council, "Court Rules Water Contracts Violate Endangered Species Act," (press release) July 29 2005, downloaded from http://www.nrdc.org/media/pressreleases/050729.asp, November 25 2005; University of California, Davis, "Rural Migration News, California Raisins, Olives," downloaded from http://migration.ucdavis.edu/rmn/more.php?id=919_0_5_0, November 25 2005

177. California Regional Water Quality Control Board, "Total Maximum Daily Load for Salinity and Boron in the Lower San Joaquin River," January 2002, p 1, downloaded from http://www.waterboards.ca.gov/centralvalley, January 9 2006

178. California Hydropower Reform Coalition, "California Hydropower Relicensing Projects," downloaded from http://www.calhrc.org/relicensing/index.asp, January 3 2006

179. California Sportfishing Alliance, "Conservation Alert Upper San Joaquin River, We Need to Restore the Upper San Joaquin River - A Forgotten River," downloaded from http://users.rcn.com/ccate/ActionAlertUpSanJoa.html, December 13 2005

180. The Bay Institute et al., "Drainage Without a Drain: Toward a Permanent Responsible Solution to the Agricultural Drainage Problem in the San Joaquin Valley," January 2003, downloaded from http://www.bay.org/Pubs/drainage.pdf, November 12 2005

181. Natural Resources Defense Council, NRDC "Coalition Wins Ruling to Restore San Joaquin River," (Press Release), August 27, 2004, downloaded from http://www.nrdc.org/media/pressreleases/040827.asp, November 26 2005

182. Stillwater Sciences, "Draft Restoration Strategies for the San Joaquin River," February 2003, downloaded from http://www.cfwc.com/, November 28 2005

183. Natural Resources Defense Council, et al. v. Kirk Rodgers, as Regional Director of the United States Bureau of Reclamation, et al. and Orange Cove Irrigation District, et al. (Defendants-Intervenors); Case No. CIV-S-88-1658 (U.S. District Court for the Eastern District of California).

184. National Audubon Society v. Superior Court, 33 Cal.3d 419, 446-447 (1983), cert. denied 454 U.S. 977 (1983).

185. CFR Title 33 – Navigation and Navigable Waters Chapter 26 – Water Pollution Prevention and Control Subchapter IV – Permits and Licenses

186. State of California, "San Joaquin River Conservancy," downloaded from http://sjrc.ca.gov/,. November 25 2005

187. Friends of the Garcia River, 'Friends of the Garcia,' downloaded from http://rcwa.us/garcia/, November 4 2005

188. Friends of the Garcia River, "Friends of the Garcia River," downloaded from http://rcwa.us/garcia/, November 18 2005

189. U.S. Environmental Protection Agency, "Garcia River Sediment Total Maximum Daily Load," March 16 , 1998, downloaded from http://www.epa.gov/owow/tmdl/examples/sediment/ca_garcia.pdf, November 18 2005

190. North Coast Regional Water Quality Control Board, "Action Plan for the Garcia River Watershed Sediment TMDL," (2002), downloaded from http://www.waterboards.ca.gov/northcoast/programs/

tmdl/garcia/docs/GarciaActionPlan.doc, November 15 2005

191. Peter Dobbins, "Local Environmentalists Celebrate Coho Salmon Return to the Garcia River," Celebrations, downloaded at http://www.celebrationsca.com/InfoCohoSalmonReturn.htm, December 10 2005

192. Craig Bell, "Evaluation of Garcia River Restoration with Recommendations for Future Projects," May 2003, downloaded from http://www.krisweb.com/biblio/garcia_tu_bell_2003_restoreval/garcia_tu_bell_2003_restoreval.htm, December 13 2005

193. Juliane Poirier Lock, California Academy of Sciences, "Forgotten Lake," California Wild, Spring 2004, downloaded from http://www.calacademy.org/calwild/2004spring/stories/clearlake.html, November 5 2005

194. *ibid.*

195. Lake County, "Clear Lake is Unique," downloaded from http://watershed.co.lake.ca.us/clkinfo/clearlake.html , November 14 2005

196. *ibid*

197. *ibid*.

198. University of California, Davis, The Putah-Cache Bioregion Project, "Bloody Island," downloaded from http://bioregion.ucdavis.edu/book/10_Clear_Lake/10_17_circ_cl_bloodyi.html, November 13 2005

199. Suchanek, T.H., et al., 2002. Evaluating and managing a multiply-stressed ecosystem at Clear Lake, California: ÊA holistic ecosystem approach. "Managing For Healthy Ecosystems: Case Studies," CRC/Lewis Press. pp. 1233-1265 (in press)

200. Conversation with Chuck Lamb, Chairman, Clear Lake Environmental Action Network, November 4 2005

201. California Department of Parks and Recreation, Office of Historic Preservation, "Five Views: An Ethnic History Site Survey for California," December 1988, downloaded from http://www.cr.nps.gov/history/online_books/5views/5views.htm , November 13 2005.

202. Larry Spears, "Superfund Site Report for Board," Lake County Record Bee, March 6, 2004, downloaded from http://www.clean-lake.org/rb030404.html, November 15 2005

203. U.S. Environmental Protection Agency, "Sulphur Bank Mercury Mine," downloaded from http://yosemite.epa.gov/r9/sfund/overview.nsf/0 732516dbab72412b8825660b007ee679?OpenDocument#threats, November 5 2005

204. California Environmental Protection Agency: Office of Environmental Health Hazard Assessment, "Fish-Mercury in Fish, Methylmercury in Fish: Information for Fish Consumers," downloaded from http://www.oehha.ca.gov/fish/hg/index.html, November 26 2005

205. Juliane Poirier Lock, California Academy of Sciences, "Forgotten Lake," California Wild, Spring 2004, downloaded from http://www.calacademy.org/calwild/2004spring/stories/clearlake.html, November 5 2005

206. Santa Monica Bay Restoration Project, "Improving Septic System Management in the Santa Monica Bay Watershed," January 2001, downloaded from http://www.santamonicabay.org/uploads/project/taskforces/SepticsTaskForceFinal2001.pdf, January 7 2006

207. State of California, Reports Administration "North Lahontan Region," (1999) downloaded from http://rubicon.water.ca.gov/v2/NLR.html, January 7 2006

208. Janis Cooke and Patrick Morris, California Regional Water Quality Control Board, "Amendments to the Basin Plan for the Sacramento River and the San Joaquin River Basins, for the Control of Mercury in Clear Lake - Final Report," December 2002, downloaded from http://www.waterboards.ca.gov/centralvalley/programs/tmdl/ClearLake/ClearLakeFinalReport.pdf, November 15 2005

209. PennEnvironment, "Empty Pockets: Facing Hurricane Katrina's Cleanup With a Bankrupt Superfund," December 2005, available at www.pennenvironment.org

210. Tahoe-Baikal Institute, "Lake Tahoe and Lake Baikal Watersheds," available at http://www.tahoebaikal.org/lakeinfo/, downloaded December 27 2005

211. California Environmental Resources Evaluation System, "Geology and Natural History of Lake Tahoe," available at http://ceres.ca.gov/tcsf/tahoe-local/geology.html, downloaded January 2 2006

212. UC Davis Tahoe Research Group, "Time for Tahoe," downloaded from http://trg.ucdavis.edu/time/default.html, November 23 2005; California Resources Agency, "Preserving the Jewel of the Sierra", California Biodiversity News, V1 No 3, downloaded from http://ceres.ca.gov/biodiv/newsletter/v1n3/tahoe.html, November 27 2005

213. Dennis D. Murphy and Christopher M. Knopp, editors, "The Lake Tahoe Watershed Assessment, Volume 1, General Technical Report, PSW-GTR-175," Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture downloaded http://www.fs.fed.us/psw/publications/documents/gtr-175, January 5 2006

214. California Air Resources Board, "The Lake Tahoe Air Deposition Study," (Presentation) December 9, 2004, downloaded from http://www.waterboards.ca.gov/lahontan/TMDL/Tahoe/dec2004_symposium/5 percent20-%20Atmospheric%20Deposition%20PPT.pdf, December 28 2005

215. *ibid.*

216. UC Davis Tahoe Research Group, "Time for Tahoe," downloaded from http://trg.ucdavis.edu/time/default.html, November 23 2005

217. Bailey, R. 1974. "Land-Capability Classification of the Lake Tahoe Basin, California-Nevada: A Guide to Planning. Forest Service," U.S. Department of Agriculture in cooperation with the Tahoe Regional Planning Agency. South Lake Tahoe, Calif.

218. Lahontan Regional Water Quality Board, "Water Quality Control Plan for the Lahontan Region," (1994) Chapter 5.8: Development Restrictions, , downloaded from http://www.waterboards.ca.gov/lahontan/BasinPlan/CH5-08.pdf, January 19 2006

219. Lahontan Regional Water Quality Board , "Water Quality Control Plan for the Lahontan Region," (1994) Chapter 1, downloaded from http://www.waterboards.ca.gov/lahontan/BMP/Chapter01.pdf, January 19 2006

220. A. Simon *et al*., "Agricultural Research Service, Sediment Loadings and Channel Erosion: Lake Tahoe Basin (Presentation)," (2004) downloaded from http://www.waterboards.ca.gov/lahontan/TMDL/Tahoe/dec2004_symposium/11%20-%20Stream%20Channel%20Erosion%20PPT.pdf, December 28 2005

221. California State University, Chico, Department of Biological Sciences, "The Eagle Lake Biological Field Station," downloaded from http://www.csuchico.edu/biol/EagleLake/ELFSgeneraldescrip.pdf, December 16 2005

222. Dan Bacher, "Eagle Lake Trout Action Hits Season Prime," FishSniffer Online, November 21 2001, downloaded from http://www.fishsniffer.com/dbacher/112001eagle.html, December 26 2005

223. Dr. Peter B. Moyle et al., "Eagle Lake Biological Field Station and Environs: an Introduction for Prospective Users," (1998) downloaded from http://www.csuchico.edu/biol/EagleLake/ELFSdescrip.pdf, December 26 2005

224. Robert Peterson, "Sailing Eagle Lake California - The lake that time forgot," downloaded from http://www.psln.com/pete/eagle.htm, December 26 2005

225. Dr. Peter B. Moyle et al., "Eagle Lake Biological Field Station and Environs:- An Introduction for Prospective Users,"1998, downloaded from http://www.csuchico.edu/biol/EagleLake/ELFSdescrip.pdf, December 26 2005

226. Dan Bacher, "Eagle Lake Trout Action Hits Season Prime," FishSniffer Online, November 21 2001, downloaded from http://www.fishsniffer.com/dbacher/112001eagle.html, December 26 2005

227. California State Water Resources Control Board, "Final 2002 Clean Water Act Section 303(d) List of Water Quality Limited Segments," available at http://www.waterboards.ca.gov/tmdl/303d_lists.html, downloaded December 28 2005

228. California State Water Resources Control Board, "Final 2002 Clean Water Act Section 303(d) List of Water Quality Limited Segment," available at http://www.waterboards.ca.gov/tmdl/303d_lists.html, downloaded December 28 2005

229. State of California, Reports Administration "North Lahontan Region," 1999, downloaded from http://rubicon.water.ca.gov/v2/NLR.html, January 7 2006

230. Spalding Community Services District, "Wastewater System," downloaded from http://www.spaldingcsd.org/wastewater.html, December 27 2005

231. California Department of Fish and Game, "California's Plants and Animals," available at http://www.dfg.ca.gov/hcpb/cgi-bin/read_one.asp?specy=fish&idNum=91, downloaded December 28 2005

232. Lahontan Regional Water Quality Control Board, "Fact Sheets Supporting Revision of the Section

303(d) List, 2005," downloaded from http://www.swrcb.ca.gov/tmdl/docs/303d_update/r6_v3.pdf, January 9 2005

233. California Department of Fish and Game, "California's Plants and Animals," available at http://www.dfg.ca.gov/hcpb/cgi-bin/

read_one.asp?specy=fish&idNum=91, downloaded December 28 2005

234. *ibid.*

235. California Department of Fish and Game, "Pine Creek Ranks as One of the Great Unknown Trout Streams in California," (Press Release), July 18, 2002, downloaded from http://www.dfg.ca.gov/news/news02/02088.html, December 15 2005

236. State of California, Reports Administration "North Lahontan Region," 1999, downloaded from http://rubicon.water.ca.gov/v2/NLR.html, January 7 2006

237. Spalding Community Services District, "Wastewater System," downloaded from http://www.spaldingcsd.org/wastewater.html, December 27 2005

238. State Water Resources Control Board, "Draft State of California SB 469 TMDL Guidance, A Process for Addressing Impaired Waters in California," March 2005, downloaded from http://www.waterboards.ca.gov/agendas/2005/june/0616-13att2.pdf, January 14 2006

239. State Water Resources Control Board, "Policy for the Implementation and Enforcement of the Nonpoint Source Pollution Control Program," (Fact Sheet), downloaded from http://www.swrcb.ca.gov/nps/docs/npsfactsheet.pdf, January 18 2006

240. Lahontan Regional Water Quality Control Board, "Water Quality Control Plan for the Lahontan Region," (1994), Chapter 1, downloaded from http://www.waterboards.ca.gov/lahontan/BMP/Chapter01.pdf, downloaded January 9 2006

241. California Air Resources Board, "The Lake Tahoe Air Deposition Study," (Presentation) December 9, 2004, downloaded from http://www.waterboards.ca.gov/lahontan/TMDL/Tahoe/dec2004_symposium/5 percent20-%20Atmospheric%20Deposition%20PPT.pdf, December 28 2005

242. California Regional Water Quality Control Board, San Diego Region, "Total Maximum Daily Load for Dissolved Copper In Shelter Island Yacht Basin, San Diego Bay," February 9 2005, downloaded from http://www.waterboards.ca.gov/sandiego/tmdls/tmdl_files/shelter%20island/final%20docs/SIYB%20Tech%20Rept%20Final%202-05.pdf, November 11 2005

243. Los Angeles Regional Water Quality Control Board, "Fact Sheet/Staff Report for the County of Los Angeles Municipal Stormwater NPDES Permit," December 13 2001, downloaded from http://www.waterboards.ca.gov/losangeles/html/programs/stormwater/la_ms4_final/StaffReportFactSheetFinal.pdf, January 14 2006

244. Building Industry Association v. State Water Resources Control Board [Case No. D042385]

245. Building Industry Association v. State Water Resources Control Board [Case No. D042385]

246. City of Santa Monica, "SMURFF: Santa Monica Urban Runoff Recycling Facility," downloaded from http://santa-monica.org/epwm/smurrf/smurrf.html, November 29 2005

247. State Water Resources Control Board and California Coastal Commission, "Plan for California's Nonpoint Source Pollution Control Program (Program Plan),"(2000)

248. Lahontan Regional Water Quality Control Board, "Water Quality Control Plan for the Lahontan Region, (1994), Chapter 1," downloaded from http://www.waterboards.ca.gov/lahontan/BMP/Chapter01.pdf

249. Heal the Bay, "Omission Accomplished: The Lack of a Los Angeles Regional Water Board Enforcement Program, 1992-1997," June 1999

250. Environment California Research & Policy Center, "Leaking Enforcement: Analyzing The Effectiveness Of The 1999 Clean Water Enforcement And Pollution Prevention Act (2003)," downloaded from www.environmentcalifornia.org/reports

251. Legislative Analyst's Office, "Improvements Needed in Clean Water Enforcement," February 16, 1999, downloaded from http://www.lao.ca.gov/analysis_1999/resources/resources_depts3_anl99.html#_1_6, January 9 2006.

252. Nonpoint Source Control Task Force, 1983. "Nonpoint Source Pollution Abatement in the Great Lakes

Basin." Water Quality Board of the International Joint Commission, Windsor, Ontario.

253. Minnesota Pollution Control Agency, Division of Water Quality. "Agriculture and Water Quality; Best Management Practices for Minnesota," pg. 22-23

254. Nonpoint Source Control Task Force. 1983. "Nonpoint Source Pollution Abatement in the Great Lakes Basin," Water Quality Board of the International Joint Commission, Windsor, Ontario.

255. Minnesota Pollution Control Agency, Division of Water Quality. “Agriculture and Water Quality; Best

Management Practices for Minnesota,” pg. 33

256. Soil Conservation Service. 1983. “Water Quality Field Guide,” United States Department of Agriculture. U.S. Government Printing Office. Washington, D.C.

257. Minnesota Pollution Control Agency, Division of Water Quality, “Agriculture and Water Quality; Best

Management Practices for Minnesota,” pg. 37

258. The Bay Institute et al., “Drainage Without a Drain: Toward a Permanent Responsible Solution to the Agricultural Drainage Problem in the San Joaquin Valley,” January 2003, downloaded from http://www.bay.org/Pubs/drainage.pdf, November 12 2005

259. Santa Monica Bay Restoration Project, “Improving Septic System Management in the Santa Monica Bay Watershed,” January 2001, downloaded from http://www.santamonicabay.org/uploads/project/taskforces/SepticsTaskForceFinal2001.pdf, January 7 2006

260. Minnesota Pollution Control Agency, “Minnesota’s Total Maximum Daily Load Study of Mercury, Draft,” Draft May 24 2005, downloaded from http://www.pca.state.mn.us/publications/wq-iw4-01b.pdf, November 29, 2005

261. U.S. Environmental Protection Agency, “U.S., State, Announce Long-Term Settlement for Iron Mountain Mine,” (Press Release) October 19, 2000, available at http://yosemite.epa.gov/opa/admpress.nsf/0/6d8c6077be9d48d68525697d005f3ad3?OpenDocument, Downloaded January 7 2006

262. National Audubon Society v. Superior Court, 33 Cal.3d 419, 446-447 (1983), cert. denied 454 U.S. 977 (1983)

263. Natural Resources Defense Council, et al. v. Kirk Rodgers, et al. (Defendants-Intervenors); Case No. CIV-S-88-1658 (U.S. District Court for the Eastern District of California)

264. CFR Title 33 – Navigation and Navigable Waters Chapter 26 – Water Pollution Prevention and Control Subchapter IV – Permits and Licenses

265. Curtis Knight, “How do dams affect our fish?” Leland Fishing Outfitters, downloaded from http://www.flyfishingoutfitters.com/content/lelandadmin/Templates/p/p37.htm , January 16 2006

266. A.J. Castelle, C. Connolly, & A.W. Johnson, “Wetland and Stream Buffer Size Requirements – A Review,” Journal of Environmental Quality

267. *ibid.*

Cover photos *(clockwise from left): San Francisco Bay*, iStock International; *East shore of Lake Tahoe*, iStock International; *Lake Tahoe-region waterfall at sunset*, iStock International; *Humbolt Bay at sunset*, Lenny Gonzalez.

Design: Harriet Eckstein Graphic Design, Santa Barbara, California